ENGINEERING NEWS-RECORD

A Consolidation of Engineering News, Engineering Record, The Sanitary Engineer, and The Contractor

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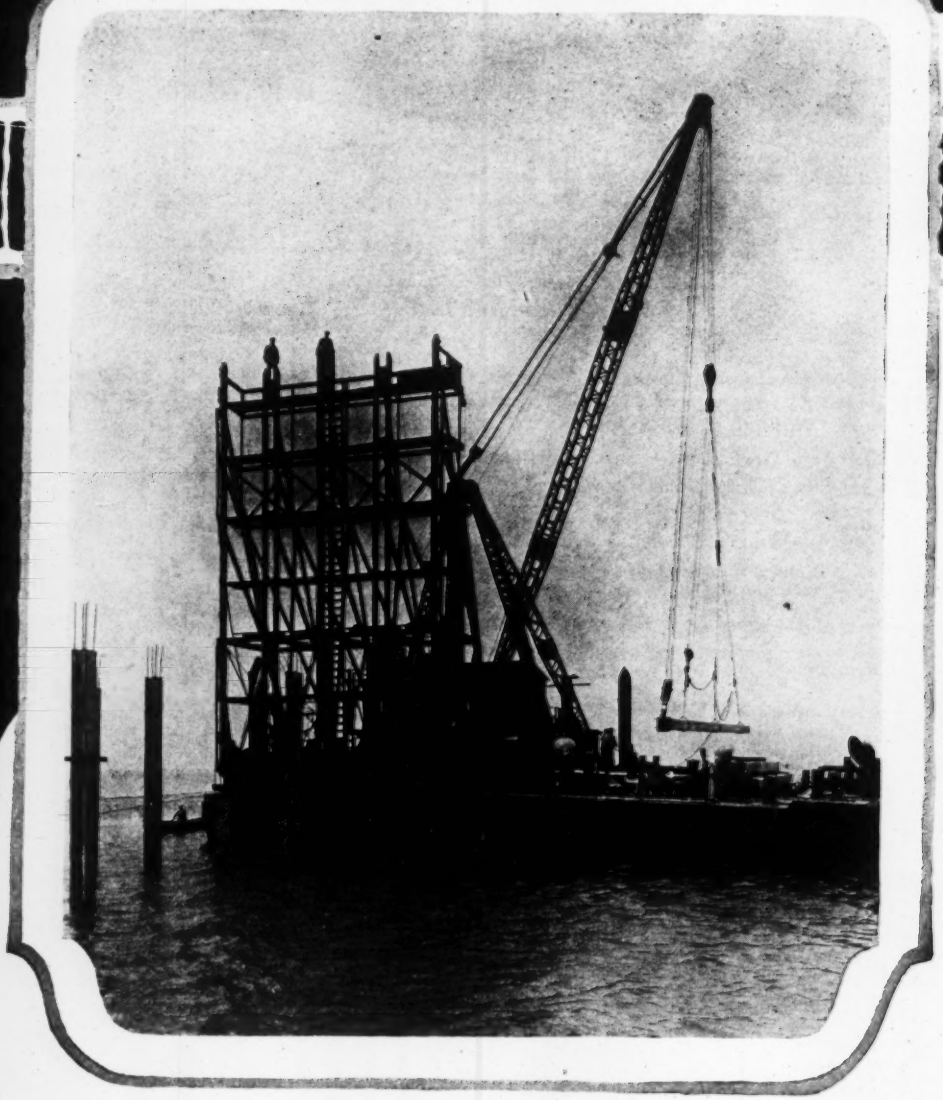

Four Lead Pile Driver used on James River Bridge.
Location—James River, Newport News, Va.
Engineer—Turner Construction Co.
Contractor—James River Bridge Corp.

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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

F. E. SCHMITT, *Editor*

Volume 103 NEW YORK, AUGUST 8, 1929 Number 6

Lack of Standards

MANY thoughtful engineers believe that too much stress is being laid on standardization, that at least in some fields standardization is being carried beyond the limit so aptly described by G. W. Thompson in his presidential address before the American Society for Testing Materials as the point beyond which the individual cannot get what best suits his needs. For this reason it is interesting to consider a case of manifestly insufficient standardizing. A letter in this issue calls attention to the multitude of special castings required for each new sewage-disposal plant. Waste, delay and needless complication result from the existing situation, both at the time of building and in subsequent maintenance. A small amount of well-planned standardizing would improve matters very greatly. The case presents a ready opportunity for the sanitary engineering division of the American Society of Civil Engineers to initiate such work. The individual engineer who designs a plant cannot standardize the castings of his sewage-disposal plant, nor go very far in adapting already standardized castings to his needs. But these things are well within the power of the society group—and power with opportunity usually implies an obligation.

Damage Made Good

PROBABLY no previous case has so tangibly brought out the degree of injury which fire can do to a steel structure as the Memphis bridge case, whose closing chapter is now recorded. The stress transfers which occurred in the chord members exposed to the heat of the burning wood floor are readily seen to be so large that the bridge would have been in serious danger if it had been kept in service unrepaired. In other bridge fires no measure of damage was obtained except by visual inspection, on which the decision either to condemn or to acquit the affected members had to be based. In the present instance, by determining through extensometer measurement that one web of the compression chord had taken on a large tension, thereby adding a heavy excess to the load carried by the other webs, the engineers who carried out the reconstruction have provided significant data as a guide to the interpretation of the effect of fire damage in a future case. At the same time the ingenuity and success of their repair work engages attention. Though it called for no special device or equipment, it reflected in both planning and execution the high degree of forethought and skill which marks the structural-steel art of the present day. It is not easy to bring new material into stress participation, as may be remembered from earlier cases where it was done; and that it could be done by the simple method of drifting is of interest. In some recent work on the New York Central, where corroded flange plates of tunnel roof girders were replaced by new plates welded in place, the stress participation was effected by gently heating the new plates, as will be described more fully in an article to be published shortly. The difference of method in the two cases, each of which appears to have been done in the way most suitable to conditions, illustrates the value of resourcefulness and intelligent study of local requirements.

Underground Facts

UNDERGROUND conditions are difficult to see, and occasionally rather disconcerting discoveries are made when old foundations are exposed. This is so in the case of the piers of the old Manhattan Life Building, one of New York's earliest high structures. Caissons with large voids under the deck carrying their load through the chamber walls instead of through their concrete filling, and one caisson resting on sand instead of hardpan or rock, are alarmingly different from what such caissons should be and are supposed to be. Yet the fact is that by the test of thirty years' service the foundations were adequate, and since they showed little deterioration it is fair to assume that they would have been adequate for years to come. Very few old caisson foundations have been uncovered, so that the Manhattan Life Building supplies unique information and a pertinent warning. It is not necessarily a unique case, however, for caisson practice of the nineties was far less developed than that of today. For example, grouting and the use of bleeder pipes to insure that the working chamber is filled came into use much later. It is therefore not impossible that other building foundation caissons sunk in the early days of the art are similarly faulty, though we have the reassuring fact that the buildings have stood secure for years. The Manhattan Life findings give the engineer reason for sober thought of the fact that foundation work once buried is past inspection or verification, and merits the utmost in scrupulous care to justify the blind faith that will ever after be reposed in it.

Difficult Underpinning

BESIDES revealing the condition of early-day building caissons, the story of underpinning the Manhattan Life Building tells of a most interesting and difficult job of reconstruction. Replacing a score of massive brick and concrete piers with steel columns carried below the level of the original piers, doing this work in exceedingly cramped working quarters and avoiding any disturbance of a 36-year-old superstructure of cast- and wrought-iron columns carrying the steel beams of the floors, was a ticklish job. The builders, moreover, were beset by difficulties not only in the actual underpinning operations but in providing a watertight wall around a deep basement area and in handling materials in and out of a job located on two of lower Manhattan's busiest streets. The complete undertaking is but another example of the skill and ingenuity which characterize the modern engineering construction organization. Close co-operation

of engineer and constructor, as seen in this work, has more and more clearly become the characteristic of engineering achievement, and bears promise of leading to still further advance.

Once Is Enough

DOUBTS have been expressed by some engineers as to the safety of the design stresses included in the code for structural welding recently made public by the American Welding Society. This is natural and quite proper, as it would be equally proper to ask whether or not the code is too conservative in its recommendations. The important thing is that its stress values are questioned. It can only be hoped that they will always be questioned and that constant and continuing efforts will be expended to check or to change them. The structural art is just beginning to make some progress against another inflexible stress value—the famous 16,000 lb. per sq.in.—and it would be a pity if another such figure should acquire a halo. One mistake of a kind is enough. Now, when the figure of 11,300 lb. per sq.in., the code value for shear on welds, is in its infancy is the time to free our minds of any idea that this figure is to stand inviolate. It corresponds to a stress of about 3,000 lb. per linear inch on a ⅝-in. fillet weld, and since several series of tests have shown an ultimate value for such a fillet of from 10,000 to 12,000 lb. per linear inch the compilers of the structural welding code regarded the code value as conservative. On the other hand, the tests on which it is based are not numerous. Also, they were made for the most part on specimens fabricated by the arc process, while the code applies to both arc and gas welding. Finally, we are rapidly making progress in producing better welds, so that in view of such circumstances it would seem folly to set present design stresses on a pedestal out of reach of all revision. The danger is not that the compilers of the code regard the present permissible stresses as permanent but that among users of the code such a viewpoint will develop.

Working Partners

AS ENGINEERING knowledge grows by dissemination and as dissemination is chiefly by the printed word and only to a minor degree by direct oral transmission, a dual obligation rests on editors and readers of a technical journal. On the editors rests the obligation to supply the news and accounts of the most important developments in the civil engineer's many fields of labor. On the readers rests the corresponding obligation to bring forward the active thinking of the working engineer, his problems and his attempts to solve these problems—in short, the living growth of engineering knowledge. It therefore is clear that a close partnership exists between engineer and editor and that unless this partnership is made effective the record of engineering progress will be imperfect. What articles does the engineer find most helpful and thought-stimulative? What of his needs is most effectively covered and what is neglected? Does he find detail sufficient for his working needs; is the scope of what his journal supplies him adequately broad? Only by making their answers to these questions known to the editors can readers do their part toward the proper functioning of their partnership in their journal. *Engineering News-Record* has been fortunate in having such co-operation. The editors, keenly appreciative of this help, ask for its continuance in even greater degree.

Percolation and Safety

IT IS axiomatic that dams are built to hold water, and that if they do not they fail to fulfill their purpose. It is equally axiomatic that a leaking dam is dangerous, since a leak tends constantly to enlarge itself. For earth dams this is recognized unreservedly, whether the leakage passes around the structure or goes through its body. It is less clearly recognized in the case of masonry and concrete dams, perhaps because water works more slowly in such materials and because the dam may survive even when a hole is opened through it. But these are doubtful reasons for ignoring the warning of leakage, especially since the history of the St. Francis dam leaves no uncertainty about the overwhelming magnitude of the danger.

Unlike many other structures, a dam is permanent. Lack of permanence spells danger, for water will rise up against the dam so long as the rains fall and rivers flow, and unless it remain safe for all time the ultimate catastrophe is merely deferred. And, in view of all mundane uncertainties, the dam must not merely be just strong enough but it must be overstrong. Quite obviously, if the engineer who plans and builds a dam does his work in the terms which he applies to a bridge wingwall, an arch or a floor, he runs imminent risk of ignoring the greater hazards that attach to indefinite length of life. Nevertheless much of the recent engineering thought concerning dams, as reflected in public discussions, has apparently done just this: it has applied the same close stress analysis, the same low factors of safety and the same moderate allowance for unknown hazards that it would use for less critical structures, planned on short-time outlook. The same thing is true of the selection of concrete mixtures and methods of construction, so far as they affect the danger of percolation. Percolation, it may be observed, is incipient leakage.

N. A. Bowers, in his instructive discussion of dam conditions in the West, sets forth clearly the meaning of percolation and the present degree of unconcern over its occurrence. If we refer to the subject here it is only to emphasize his statements. There are many dams which show visible leakage, even some that were built with a high degree of care. The thoroughness of careful method applied to the best present-day dam construction is strikingly shown by the account of the work on the Bull Run dam, which by chance is also published in this issue. Yet, since the leakage case cited by Dr. Bowers include one dam built with as much effort to obtain perfect work as the Bull Run structure, it seems that care alone is insufficient guarantee of tightness. Even regular laboratory tests to keep a check on tightness of mix do not give entire assurance, since a large structure cannot be made as uniform as a testpiece. Dam concrete on the Coast has in several recent cases been brought to a standard of one barrel of cement per yard of concrete, four cubic feet in twenty-seven; such concrete may show perfectly impervious in the laboratory, but only the severest tests of practice can prove that it will make a tight dam to withstand several hundred feet of water head.

What results from continuing percolation is something of which no full picture has yet been drawn, but there are many suggestive indications. Extensive deposition of calcium carbonate by the leakage water, or softening of the concrete on the upstream face, gives imperative warning that the action of the percolation should be watched. On present data the unavoidable conclusion is that steady percolation — in other words, leakage — will sap the strength of the dam and lead to failure.

Seepage, of course, is tied up with more factors than concrete density alone, and the safety of a dam depends on more than seepage. There are shrinkage, cracking, and sealing of expansion joints, none of them easy to dispose of; and the dangerous potentialities of cracking have been revealed glaringly by the St. Francis failure. There are foundations, drainage and shear-stress problems, and others. Each presents its difficulties and furnishes a reason for conservative rather than close design. For, as stated in the opening, a dam must serve permanently. But if percolation through the body material can be prevented, a step forward will be made by eliminating a source of danger now underestimated.

The Next Step in Airports

AIRPORT construction, while still far from adequate either in volume or quality, has reached a stage that is fairly satisfactory, especially when one considers the speed with which new construction is being inaugurated and pushed through to completion. In every new field of progress the period of early growth must necessarily be characterized by boom methods—snap-judgment design and high-pressure construction. In the field of airports this period would seem to have run its course, making the time close at hand when aviation interests must take stock of their actual needs. It is not enough to express opinions. The civil engineer charged with designing and building airports that will adequately serve present needs and be reasonably susceptible of development for future requirements is now beset with too many diametrically opposed opinions and estimates. What is necessary is a sane and careful analysis by the aeronautics industry of just what its ground needs include. Unless this is done there is danger that a backsight five years from now will reveal costly mistakes.

At the present time there has developed a situation with regard to hard-surfaced runways that supports this contention. It is this: The urgent need for hard-surfaced runways that has arisen with the accelerated airport activity of the past year or two has led advocates of the various hard-surfacing materials (commercial and technical interests affiliated with the civil engineering profession) to recommend the use of existing highway specifications without any warning that these specifications may prove to be either inadequate or too drastic. It is patent that this attitude fails to take into account developments which the future may bring forth, and perhaps it is only the exigencies of the moment necessary to overcome present sales resistance that are back of this unreserved approval of highway practices for airport uses. But it is also true that some specifications must be used at the moment, and none is available, since the aeronautics industry has not codified its knowledge of runway requirements. At any rate the danger of using highway specifications in this manner is plain; airport engineers may accept such specifications without question and in time come to regard any attempt to verify them by test as unwarranted expense.

There are other instances where closer co-operation between aviation and civil engineering would be lastingly beneficial. What really is going to happen to the turf-destroying tail skid? Where should the administration building be located on the field? How large should it be? How tall can it be? Should it incorporate the passenger and freight facilities? Where should weather instruments be located and how should they be housed? How wide is wide enough for a hangar opening? What attitude should be taken toward the growing tendency to make aviation beacons the crowning architectural achievement of tall buildings? The list could be lengthened indefinitely.

It is not that the aeronautical industry does not know the answer to these questions. It does—subject, of course, to the vagaries of future developments, and even here it has a rich background for sound estimation. An open and inquiring mind has always been the backlog of civil engineering progress. A natural concomitant of such a desire to acquire knowledge is a sense of the value of co-operation. The civil engineering profession requires the help of aeronautics as a unified industry, in order that aviation's interests may be best served. The next step in airports, therefore, should be careful analysis and expression of its needs on the part of the aeronautics industry itself.

Railroad Consolidation

RAILROAD consolidation developments in this country appear about to enter a new stage. When grouping of the railroads into a small number of strong systems was first proposed, the responsibilitiy for the preparation of a general plan for that purpose was placed upon the Interstate Commerce Commission. It soon became evident, however, that it would be impossible for the commission to force such a plan upon the railroads even if it could prepare a workable one. Consequently matters were allowed to drift along, with the railroads proposing conflicting consolidation plans of their own and the commission both unable and unwilling to do much to straighten them out. During the past two or three years, however, the increased prosperity of the railroads has greatly stimulated interest in consolidation plans, and the commission now has before it what it did not have in the first instance—namely, enough different proposals for the formation of large systems by various railroad companies or groups of companies to give it a fair idea of what major grouping can be made which will serve the public's interest and at the same time stand a good chance of being accepted by the railroad companies as a whole.

In view of this development and of the disinclination of Congress to release the commission from the responsibility of preparing a general consolidation project, a plan has been prepared by one member of the commission and is now before the entire body for study.

Details of the plan have not been made public. If it meets with general approval by the commission it is understood that the commission will make it public when it resumes hearings on the railroad consolidation plans now before it and will ask the railroads to show cause why they should not accept such a plan.

How effective this new method of approach will be cannot be judged until the character of the new consolidation plan is known and until the commission gives some idea of how closely it will attempt to adhere to it. Without doubt it cannot be made fully effective without added legislation. It may, however, after it has been the subject of extended hearings, provide the groundwork for legislation which will be more workable than that now on the statute books. The present situation has proved a complete deadlock. That progress must come by way of a new departure is the only fact now definitely obvious.

The Bull Run Storage Dam for Portland, Ore.

Gravity Section 200 Ft. High Arched in Plan to Prevent Sliding—Denser Mix on Both Faces—Strict Sanitary Rules Govern 500-Man Camp on Watershed

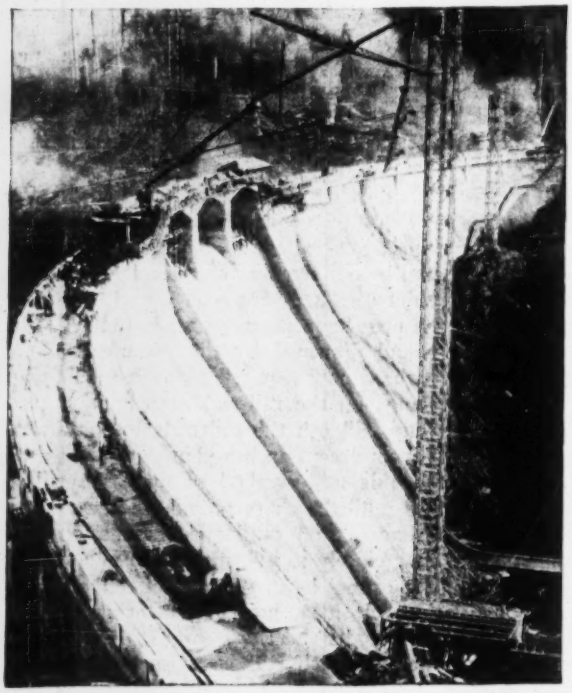
By B. E. Torpen

Formerly Superintendent of Design and Construction, Bull Run Storage Project, Portland Bureau of Water Works

COMPLETION of the Bull Run dam by the Water Bureau of the city of Portland, Ore., adds 31,000 acre-ft. of storage to the natural flow of the Bull Run River, which forms the source of the water supply for about 400,000 consumers in that city. This reservoir will permit regulation of the river to a minimum flow of 265 sec.-ft. (170,000,000 gal. daily). The mean annual per capita consumption is 106 gal. per day (g.p.d.), with a peak month averaging 162 g.p.d. during the late summer. Based on estimated increase in population, this additional storage will meet the city's needs for 30 to 40 years. The hydrology of the watershed and the preliminary design of the dam were described in *Engineering News-Record*, May 26, 1927, p. 842.

The country rock at the dam site is basalt from lava flows of the Mesozoic period. The Bull Run River has cut through successive layers of this rock 50 to 100 ft., until its present bed is in a dense black basalt with a specific gravity of 2.80 and a crushing strength of 20,000 lb. per sq.in. The upper layers, with a strength of 7,000 lb., are altered scoriaceous basalt and were extensively excavated to secure fresh rock for the abutments in the upper 75 ft. of the dam.

At a depth of 25 to 60 ft. under the base of the dam the drill holes intersect a plane of artesian water with a pressure of 75 lb. per sq.in., proving the black basalt layer to be watertight. Several of these holes were piped to discharge at the downstream toe; others were vented to the main drainage gallery in the dam to eliminate back pressure. A steady flow of about 1 sec.-ft. is maintained.



POURING THE LAST CONCRETE ON THE CREST OVER THE SPILLWAY
Raised section intentionally provided, blocking possible future roadway to protect water supply.

Design—A concrete gravity dam, 200 ft. high, was selected as most suitable for the site and was arched in plan on a 600-ft. radius to assist in preventing sliding and to reduce uplift. The weight of concrete was assumed at 148 lb. per cu.ft. in the design computations. Tests during construction showed the average dry weight to be 154 lb. per cu.ft. and the saturated weight about 158 lb. With a full reservoir during six months of the year, concrete may be assumed to be partly saturated when the dam is loaded.

Uplift assumed in the design was 100 per cent hydrostatic head at the heel, diminishing to the tailwater head of 23 ft. at the line of drains, which is about 20 ft. downstream from the upstream face. Full tailwater uplift was assumed over the rest of the area. At the upstream face a cutoff trench was excavated 6 ft. below the finished foundation extending the entire length of the dam.

Grout holes 50 ft. deep were drilled in this trench at 10-ft. intervals. About 20 ft. downstream from the grout holes, 2-in. drain holes were drilled 50 ft. deep, spaced at 10-ft. intervals and vented to the 7x10-ft. drainage gallery as shown in the accompanying section. To prevent uplift on horizontal construction joints, a set of horizontal and vertical drains was installed.

The cost of all the precautions taken to reduce uplift, such as water stops, drains, grouting, drain holes into the bedrock and cutoff trench, totaled $135,000. Without these measures, if uplift had been assumed on 100 per cent of the area varying from 100 per cent at the upstream face to tailwater at the toe, the additional concrete required to balance this uplift would have cost $250,000.

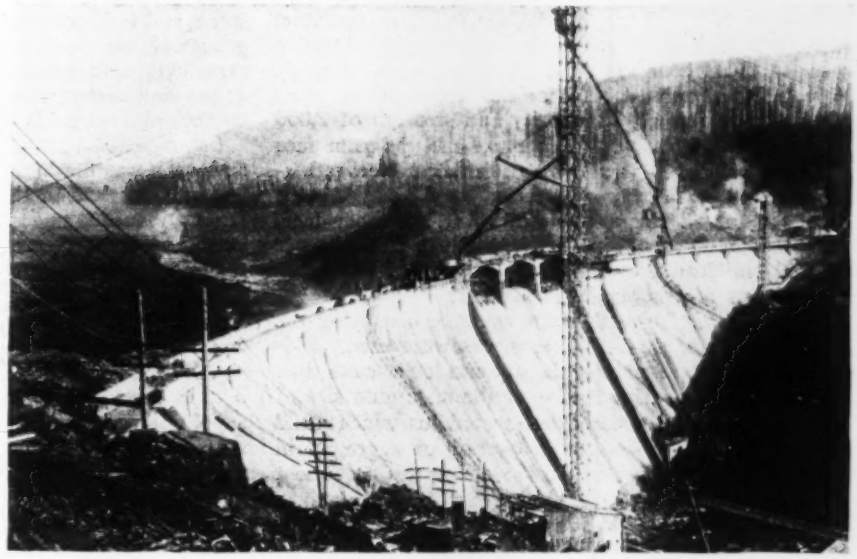
The drainage system in the dam consists of 3-in. horizontal drain tile on each horizontal pouring joint, carrying seepage to the 6-in. vertical drains spaced at 10-ft. intervals connecting with the drainage gallery near the base. These drains proved difficult to place and plugged easily on account of their small size. It is believed that better results could be obtained with 4- to 6-in. horizontal drains placed carefully on line so they could be rodded out and vertical drainage wells 3x3 ft. at each contraction joint to replace the four lines of 6-in. vertical drains as used. Large drainage wells would permit inspection and cleaning of all the horizontal drains, thus insuring continuous operation.

Radial contraction joints with frequent offsets are provided at 40-ft. intervals measured on the upstream face. Seepage is checked by a 24-in. copper water stop, 2 ft. from the upstream face, placed to cover the downstream half of a vertical 6-in. hole which was subsequently filled with moist, well-tamped clay, and a ver-

tical drain is provided in the joint to catch such seepage water as may pass the stop.

The resultant of forces is kept within the nominal middle third, allowance being made for the convergence of the radial sides, and tension is eliminated at the heel by sloping the upstream face on a batter of 1 to 25, beginning 50 ft. below the top. The maximum compressive stresses are 180 lb. per sq.in. at the heel for reservoir empty and 270 lb. per sq.in. at the toe for reservoir full. These stresses are considered moderate for such excellent foundation rock and with 3,000-lb. concrete will give a safety factor of more than ten.

The maximum compressive stresses in the dam are parallel to the downstream slope, which is 7 : 10 except near the base, where it is increased to 8 : 10. The maximum inclined load is taken as $1/\cos^2 \theta$ times the vertical load, and the sliding factor is 0.70.



BULL RUN DAM AND CLEARED RESERVOIR SITE
The 31,000 acre-ft. stored by this dam will more than double the water supply of Portland.

The drainage area above the dam is 74 square miles, with a maximum flood estimated at 21,000 sec.-ft. Such a flood would fill the reservoir in less than one day, so the effect of pondage will not be a material check for flood peaks. The annual mean flow is 560 sec.-ft. and spill will occur during six to eight months.

The spillway design was based on the results of elaborate tests made with a one-twentieth size model (*Proceedings*, Am.Soc.C.E., March, 1928, p. 857). The spill is carried over and down the center portion of the dam and along a horizontal spillway apron 150 ft. long to blocks with inclined surfaces which deflect the sheet of water upward to prevent scour for some distance below the apron. The three spillway openings in the dam crest are 14x40 ft. with provision for steel roller gates between 8-ft. piers. The free overfall is 175 ft., and under flood conditions the falling sheet will have a velocity of more than 100 ft. per second. The apron is constructed of 4,000-lb. concrete at 28 days, 3 ft. thick, reinforced with 1¼-in. rods spaced 2 ft. each way and anchored to the cleaned bedrock by 8-ft. x 1½-in. diameter rods.

The deflecting blocks at the end of the apron are 10 ft. wide by 5 ft. high and in alternate lengths of 12.5 ft. and 25 ft., sloping upward in a downstream direction. It is estimated that with a spill of 2,500 sec.-ft. or less the apron will remain submerged about 8 ft. deep and a small standing wave will form near the toe of the dam. With greater floods, the flow will probably clear the entire apron, the thin falling sheet continuing along the apron at high velocity and deflecting upward at the blocks in two different sets of parabolas. This is intended to spread the falling water over a wide area, far removed from the dam, and with the excellent bedrock should eliminate serious scour.

South of the spillway an outlet structure with trash racks the full height of the dam supports the gatehouse, which contains controls for raising the seven sliding gates. These gates control the flow of water into an inner shaft, which also extends the full height of the dam. Four eccentrically hung structural steel butterfly gates, 5x8 ft., in the bottom of this shaft open under a 7-ft. differential of head. This prevents a difference in water level inside and outside the tower greater than 7 ft., permitting lighter construction for the slide gates and outlet structure.

From the base of the shaft water passes through three 4-ft. steel outlet pipes with 4-ft. emergency butterfly valves at the upper end and 3-ft. needle valves at the lower end discharging into the open air. The butterfly valves are reached from an operating gallery in the interior of the dam. The needle valves are used to regulate the draft from storage which flows down the river channel 5 miles to the point of diversion.

North of the spillway two 8-ft. steel penstocks with butterfly valves are installed for future generation of power. A 5.5-ft. under-sluice is provided on each side of the river channel, under the outlet pipe and the penstocks.

TOTAL COST OF THE BULL RUN STORAGE PROJECT IN ROUND NUMBERS

Heavy highway construction to dam site	$250,000
Surveys, borings, city camp, engineering and inspection	250,000
Dam contract and extras	1,500,000
Cement contract	500,000
Reservoir clearing contract	200,000
Interest during construction	100,000
Total	$2,800,000

COMPARISON OF ESTIMATED AND ACTUAL COSTS

Item	Contract Estimates Quantity	Price	Amount	Actual Cost, Total Quantity	Amount
Com. ex. above 870	32,000 C.Y.	$1.50	$48,000	32,325	$48,487.50
Com. ex. below 870	20,000 C.Y.	1.30	26,000	16,900	21,970.00
Solid rock ex. above 870	45,000 C.Y.	2.50	112,500	53,930	134,825.00
Solid rock ex. below 870	10,000 C.Y.	4.00	40,000	2,990	11,960.00
Backfill	15,000 C.Y.	0.75	11,250	16,470	12,352.50
Plain concrete	230,000 C.Y.	4.30	989,000	219,187	942,504.10
Reinf. concrete Class "A"	2,500 C.Y.	9.00	22,500	3,090	27,810.00
Reinf. concrete Class "B"	1,200 C.Y.	21.00	25,200	925	19,425.00
Reinforced steel	300,000 lb.	0.05	15,000	294,830	14,741.50
Structural steel	175,000 lb.	0.10	17,500	163,100	16,310.00
Steel pipes	475,000 lb.	0.075	35,625	450,550	33,791.25
2-in. drain and grout holes	10,000 ft.	4.50	45,000	12,745	57,352.50
Misc. items			52,800		64,247.15
Total			$1,440,375		$1,405,776.50
Approximate extra work					75,000.00
Grand total					$1,480,776.50

Cement Economy—With maximum compressive stresses of 180, 150 and 270 lb. per sq.in., respectively, at the heel, center and toe of the dam, high compressive concrete throughout the structure would be a waste of cement. Concrete for the interior mass of the dam was designed for weight, density and strength of 2,000 lb. per sq.in. at one year. To make the upstream face more impervious and the downstream face more weather-resistant, an extra sack of cement per 2.3-cu.yd. batch was used for all concrete within 15 ft. of either face. This resulted in increasing the strength to 3,000 lb. per sq.in. at one year. A wide zone was allowed for merging one class of concrete into the other.

For the lower strength mass concrete occupying the bulk of the dam, large-size aggregates were used, yielding higher strength, greater density and lower costs than small aggregates. Also the larger the maximum size of aggregate the greater the fineness modulus which could be used and the greater the proportion of aggregate in the mix. This resulted in the use of less paste (cement and water). With a maximum amount of aggregate, which is the heavy, low-cost constituent, and a low water-cement ratio paste in sufficient quantity to give a plastic mix, an excellent quality of concrete was produced.

In such structures as the Bull Run dam the number of barrels of cement per yard of concrete is not as important as the quality of the concrete, which, in turn, depends on the quality of the paste content. If the paste is of a low water-cement ratio, the result is probably good, impermeable concrete. Large aggregate is an important factor in attaining this quality with the least amount of cement. The largest size of aggregate used in the dam was obtained with the cobble screen set to yield a 5- to 7-in. size, giving a maximum size averaging about 6 in. The use of larger size cobbles was tried at first but was discontinued because of clogging of the concrete chute lines.

Rigid inspection during construction of the Bull Run dam maintained a uniform grading of aggregate and consistency of slump, and secured proper curing of the concrete by constant sprinkling for the first two weeks. The impermeability of the concrete was greatly increased by this careful moist curing. Impermeability tests showed that concrete with a water-cement ratio of 1.0 or less is practically watertight if it has been properly cured. It is believed that for gravity dams like Bull Run every effort should be exerted to secure a watertight impermeable concrete. However, increasing the amount of cement in a dam is only one means of securing this result. Other equally important factors are: (1) low water-cement ratio; (2) careful grading of aggregate, especially the sand; (3) careful placing and spading; (4) proper curing.

The city maintained a testing laboratory with full field equipment at the dam site for testing sand, cement and concrete. Also, under the supervision of a special committee of the arch dam committee of the Engineering Foundation, testing devices were installed in the dam, including 21 telemeters for measuring strain, stress and temperature; 38 resistance thermometers; six groups of strain gages in the galleries for measuring deformations with an extensometer; 34 groups of strain gage points across contraction joints, and 21 uplift points on rock and on work joints.

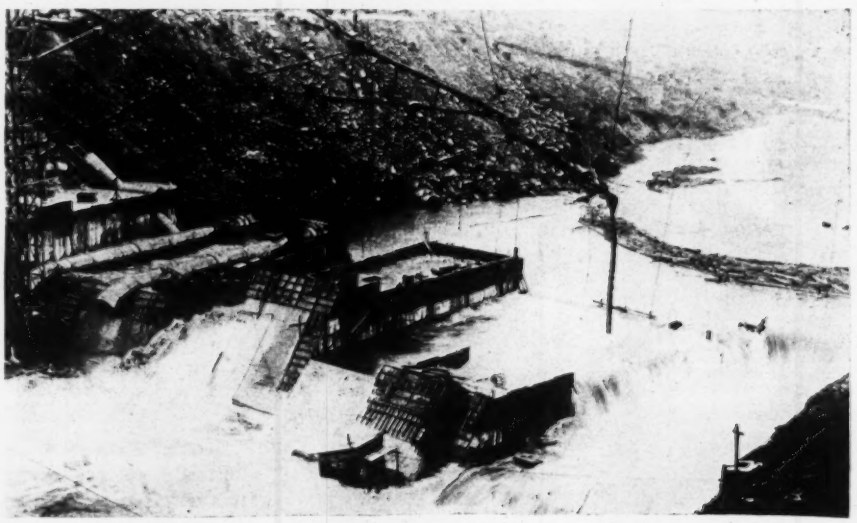
Camp—Bids for the dam were opened Feb. 9, 1927, and work was begun at once on a temporary 11,000-volt transmission line to the site. The location is 10 miles from a railroad, and all material and supplies, including 200,000 bbl. of cement, were trucked over a graveled road to the site, aggregate being transported by a construction railroad from the gravel beds below the dam.

Camp facilities were constructed for 300 men in the crew of the dam contractors, 125 men engaged in clearing the reservoir site and 50 men for the city. Located 5 miles above the headworks for the Portland water supply, it was necessary to enforce the strictest sanitary regulations at the camp, and the slightest infraction of the rules was followed by immediate dismissal.

The city installed a complete sewerage system to serve all camps, a concrete septic tank, a chlorinator to sterilize the effluent and a set of duplicate electrically operated pumps to raise the effluent over a hill into the next watershed. As an additional precaution a chlorinator was installed at the headworks. Water samples were taken from the river at various places and tested daily. After a two-year construction period with 500 men employed in the watershed area no harmful results had been noticed by the city.

A 5-ton cableway 1,500 ft. between towers was erected to assist in excavation and to provide transportation to the various parts of the dam. Another cable 2½ in. in diameter was used to support the concrete chutes and counterweights.

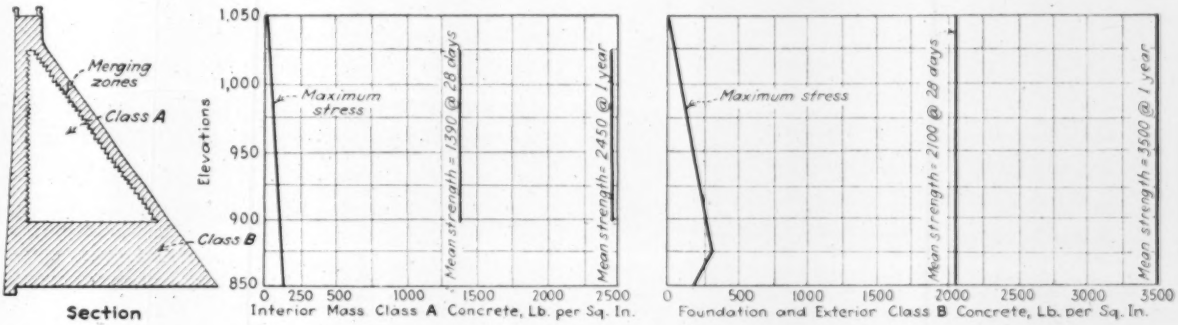
Excavation and Grouting—Excavation was begun in May, 1927, using power shovels and trucks. A cofferdam was constructed 150 ft. upstream from the dam site and the low flow was passed over the foundation work in wooden flumes. The cofferdam, which consisted of rock and earth fill, made with material from the excavation, was not watertight and the difficulty in securing complete diversion delayed the early excavation work. Floods during the early part of the work which took out flumes and cofferdams caused further delay.



FLOOD INTERRUPTS CONSTRUCTION
Progress shown had been made in seven months from beginning excavation.

An excellent quality of bedrock was found after removing 10 ft. of gravel and boulders in the streambed. The quality of this rock was such that the 4-ft. depth of rock excavation called for in the plans was reduced, resulting in a saving of 8,000 cu.yd. of solid rock excavation.

The lower side walls were practically bare rock and were excavated sufficiently to give good, solid abutments in the proper planes. Considerable cover existed at the upper levels and more than 50,000 cu.yd. of material was excavated from the north side. Grout was applied in the 2-in. grout holes under 100 lb. per sq.in. pressure, which was maintained until refusal. Very little grout was used under the main portion of the dam, the amount varying from one to five sacks of cement per hole. At the upper part of the abutments the rock was found more seamy and required considerable grout, especially at the north abutment near the top, where one hole took 1,200 sacks.


Merging zones
Class A
Class B
Section
Elevations
1,050
1,000
950
900
850
Maximum stress
Mean strength = 1390 @ 28 days
Mean strength = 2450 @ 1 year
0 250 500 1000 1500 2000 2500
Interior Mass Class A Concrete, Lb. per Sq. In.
Maximum stress
Mean strength = 2100 @ 28 days
Mean strength = 3500 @ 1 year
0 500 1000 1500 2000 2500 3000 3500
Foundation and Exterior Class B Concrete, Lb. per Sq. In.

DISTRIBUTION AND STRESS-STRENGTH RELATION OF THE TWO GRADES OF CONCRETE

Aggregate—Aggregate for the concrete was secured from river gravel bars about 3 miles below the dam. The gravel was loaded by dragline into side-dump cars and hauled to the dam site by oil-burning locomotives on standard-gage tracks. At the dam the cars dumped into a hopper with a 12-in. grizzly, from which a 30-in. conveyor belt 200 ft. long lifted the material to the screening and washing plant over the bunkers.

The gravel from the river bars contained a large amount of watersoaked sticks and débris. The larger sticks were hand picked off the conveyor belt, but the smaller ones could not be caught and because of their weight were not removed in the washing process. Tests of concrete made from aggregate containing 2 per cent of sticks by volume showed a 15 per cent loss of strength. The problem was solved by installing blowers which removed the sticks from a falling sheet of gravel by proper regulation of the air current (*Engineering News-Record*, April 12, 1928, p. 599).

Sand from the river bars in this wooded region also contains considerable fine vegetable matter. This could not be entirely washed out and may have slightly affected the concrete strength, but samples taken daily throughout the job indicate that strengths were maintained higher than the specified requirements.

Another interesting feature of the washing plant was the construction of a small reservoir to permit the re-use of wash water. The muddy water could not be wasted into the river, as it required days of settlement in the city reservoirs for it to clear.

Concrete Proportioning—Five sizes of aggregate were produced in the screening plant. An excess of any size material was adjusted by crushing the oversize. The large-size aggregate was measured through aggremeters or batchers located under the bunkers. The sand was measured in inundators and because of the low cement content for the mass concrete, about 10 gal. of water had to be drawn off from each batch. This dehydration produced many mechanical difficulties, which were gradually overcome. Better results might have been obtained if the sand bins had been farther removed from the washer, allowing better drainage.

Little trouble was encountered in securing proper grading of the coarse aggregate, but maintaining the proper fineness modulus for the sand required continual attention, since both the river product and the sand made by crushing were short in fines. In order to overcome a harsh and unworkable mix resulting from the coarse sand, a fine sand was hauled in to maintain the proper grading. With the large inundators and the dehydration necessary at this plant, every effort was made to keep the sand grading uniform to eliminate changes in the proportion.

A typical batch of concrete as used near the faces of the dam follows:

Proportions	Dry Rodded, Cu.Ft.	Characteristics
Water	8.7	Corresponding mix, 1 : 7.5
Cement	9.0	Yield, 67.5 cu.ft. of cement
Sand—0 to ¼ in.	20.9	bbl. cement per yard, 0.96
		Water cement ratio, 0.97
Agg. ¼ in. to 1 in.	9.9	Slump, 3 to 4 in.
		Density, 0.894
Agg. 1 to 3 in.	13.2	Weight per cubic foot, 154 to 158 lb.
Agg. 3 to 5 in.	24.4	Strength, 2,100 lb. at 28 days
Cobbles 5 to 7 in.	16.5	
Total	102.6	

The 220,000 cu.yd. of mass concrete in the dam contains cement varying from 0.75 to 1.50 bbl. per cubic yard. The average cement content for the mass concrete is 0.88 bbl. per cubic yard. Including cement used for grouting and other purposes, the percentage is nearly 1 bbl. per cubic yard.

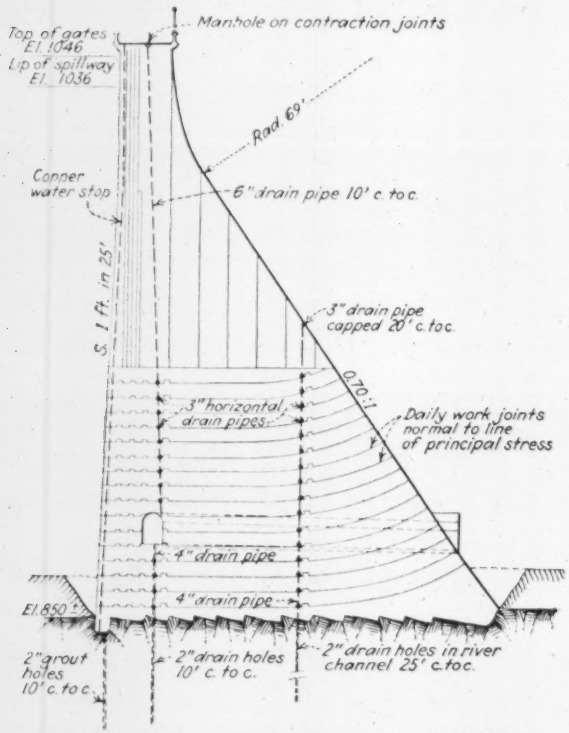
Mixing and Placing—Concrete placing began during August, 1927, and was continued one shift daily, averaging about 600 cu.yd., except for a period of five months, when pouring in the thickest part of the dam was continued two shifts daily. Pouring of the 220,000 cu.yd. of concrete in the dam was finished in January, 1929, less than two years after the contract was signed.

The charging cars containing the measured aggregate and sand were hauled about 100 ft. by gasoline locomotives to hoppers, where the batches were dumped directly into two 2-yd. drum mixers. The cement came through chutes from the cement shed directly above and was added at the same time.

Time of mix was two minutes and only 2½ minutes

elapsed between batches. The mixers dumped directly into the skip of a double-compartment steel hoisting tower 375 ft. high. Skips were raised at a speed of 600 ft. per minute to 2-yd. hoppers, which emptied into 20-in. chutes serving the whole dam through boom plants or 60-ft. counterweighted chutes and elephant trunks. About 13,000 cu.yd. in the south end was rehoisted in a 180-ft. single-compartment tower.

Pouring was done in 4½-ft. daily lifts, using 5x7-ft. wood panel forms, anchored to loops left in the previous pour with No. 9 wire. On the top of each pour three raised horizontal keys, 8 in. high by 20 in. wide, were


Manhole on contraction joints
Top of gates El. 1046
Lip of spillway El. 1036
Rad. 69'
Copper water stop
6" drain pipe 10' c. to c.
5 ft. in 25'
3" drain pipe capped 20' c. to c.
0.70:1
3" horizontal drain pipes
Daily work joints normal to line of principal stress
4" drain pipe
4" drain pipe
El. 850 ±
2" grout holes 10' c. to c.
2" drain holes 10' c. to c.
2" drain holes in river channel 25' c. to c.

SECTION OF DAM, SHOWING DRAINAGE SYSTEM

formed as shown in the accompanying drawing. These keys were to assist in producing watertightness and to direct seepage to the vertical drains.

After initial set the surface of the concrete was washed and wire brushed until clean aggregate showed. The 3-in. horizontal tile drains were then laid near the face of one of the raised keys to connect with the 6-in. vertical drains. These horizontal drains were then covered with pea gravel as a protection from the following pour, which usually was made within 48 hours. All concrete was kept wet by sprinkling until two weeks old. Before starting the new pour the surface was cleaned up after the carpenters and given a slush coat of grout. Following the grout, two batches of concrete without cobbles were placed to make a bed for the regular concrete.

To minimize the effect of the usual rise in temperature of the setting concrete, an effort was made to carry the dam up to as nearly level as possible and pour alternate sections within about 48 hours before the concrete had attained more than a 10 deg. rise in temperature. It was hoped that in this way the contraction-joint openings would be reduced materially.

The upstream parapet wall is solid to resist wave action, but the downstream concrete hand rail is open. Lampposts are spaced 40 ft. apart on the downstream hand rail. The upstream face of the dam was given three coats of cement paint for appearance and to improve watertightness.

The general contractor for the dam was Bent Bros., Inc., Los Angeles, Calif. K. L. Parker was construction superintendent for the contractor. Clearing the reservoir site was done by Heller Bros., Portland. The project was carried out under the direction of J. M. Mann, Commissioner of Public Utilities, Portland, with Ben S. Morrow as chief engineer of the Water Bureau. Ira A. Williams was consulting geologist and D. C. Henny consulting engineer on design and construction. J. J. Karstetter and A. Bauer were assistant engineers on the project; T. C. Powers was concrete technologist, and the writer was superintendent of design and construction, directly in charge of the work.

Dynamometer and Dynagraph Car for Brazil Railways

A TEST car built recently for the Central Railway of Brazil serves the double purpose of testing and recording the power of locomotives and the condition of the track. These different records are not made simultaneously, as the chart would be very complicated and would require an inconveniently wide roll of paper. Furthermore, the dynamometer records are held by the testing crew for working up the results of tests, while the track inspection records need to be sent promptly to the maintenance-of-way engineers. For the dynamometer records, therefore, a chart 24 in. wide is used, on which are traced six base or datum lines and eighteen record lines. For the track inspection, a 12-in. chart is used, on which are traced records for gage, cross-level and low joints on each side of track, together with time intervals, speed, distance and location. The records are made at the same table or chronograph, the pens and connections being adjusted as required.

For dynamometer service there is the usual weighing head, with a vertical lever attached to the drawbar and operating the two pistons for drawbar pull and buffing. Other records include brake pressure, boiler pressure, fuel consumption, speed, stations, kilometer marks and time intervals. For track inspection, the gage is measured and recorded by wheels held against the rail heads by springs, while low joints are recorded by an axle-box attachment, and cross-level by means of a gyroscopic device. Low joints and irregular gage are marked by spots of paint ejected from point-guns.

This car, 53½ ft. long, has heavy steel framing and is mounted on a pair of four-wheel trucks having 38-in. wheels and the Brazilian standard gage of 5 ft. 3 in. It was built and equipped by the Baldwin Locomotive Works, which also supplied the complete dynamometer equipment, while the track inspection equipment, including gyroscope apparatus, was furnished by the Sperry Development Company. The general plans and requirements for the car were prepared under direction of P. A. Martins Costa, chief mechanical engineer of the Central Railway of Brazil.

Large Flood Gate for Germany

Construction of a large flood gate at Bremerhaven, Germany, capable of passing steamers of 50,000 tons displacement, has been started. The gate will be 1,000 ft. long and 43 ft. deep.

Heavy Dry Dock Gate Jumps Ways in Launching Mishap

415-Ton Floating Gate for Brooklyn Dry Dock Jacked and Skidded Back Onto Ways and Relaunched After Accident

FAILURE to release one end of a 415-ton steel floating gate for a Brooklyn dry dock when launching caused the gate to leave one of the ways and come to rest in an awkward and precarious position. Jacking and skidding the heavy structure back onto the ways for relaunching was a difficult and interesting operation because of its shape, similar to a ship's hull, narrow at the keel and top-heavy. The gate, shown in Fig. 1, a hollow steel structure 90 ft. long and 30 ft. high, was built broadside to, for side launching from two sets of existing shipbuilding ways. The inclination or declivity of these ways was $\frac{3}{4}\frac{3}{2}$ in. to 1 ft., the gate built about 90 ft. from the outboard end of these ways. The structure was originally ready for launching Nov. 24, 1928, and was successfully launched Dec. 29, 1928. The plans for releasing contemplated sawing through the two outside stringers of the sliding ways and then upon cutting about twelve strands of 3-in. rope which had been wrapped around both the sliding and ground ways. When the signal was given to cut the ropes, this was promptly done on one side, but on the other side the man in charge misunderstood the signal and failed to cut the rope, so that the side released slid down the ways, about 18 ft., when preventer or cross-stays of wire rope pulled the northerly two sliding ways off the ground ways and stopped the downward motion, in the position shown in Fig. 2.

Jacking and Skidding Operations—The sliding ways on the low side left the ground ways and were bearing directly on the pile caps of the ground way foundations. This gave a height of 24 in. between the foundation caps and the caisson at the low end and 33 in. at the high end. This clearance permitted two 16-in. H-sections to be slipped under the keel at the low end, with room for two hydraulic jacks and the insertion of two 26-in. girder beams under the high end.

As shown by Figs. 2 and 3, two 150-ton jacks were placed between the beams at the low end on a 2-in. plate, which was supported on the lower flanges of the H-sections. This permitted transferring the load from the jacks to the top flanges of the beam by inserting shim plates as the gate was raised. By this means the low end was raised about 21 in. until it was level with the high end, which during this raising came to rest on the two 26-in. beams. In raising the gate gages were used to determine the pressure in each jack to insure even distribution of the load.

The two top plates immediately under the keel on the low end had been separated by a coat of grease and graphite and then bolted together to prevent slipping.

At the high end a 48x$\frac{3}{4}$-in. x 6-ft. plate was set against the keel and below this a 48x$\frac{3}{4}$-in. x 5$\frac{1}{2}$-ft. plate was placed. The contact surfaces of these plates were also covered with grease and graphite. This last plate, as shown in Fig. 3, was provided with shackles to which two sheave blocks were attached, and these in turn were secured to the outboard end of the 26-in. beams (Fig. 4).

A $\frac{7}{8}$-in. wire rope was rove through the four set of sheaves, making a seventeen-part line, the bight being led

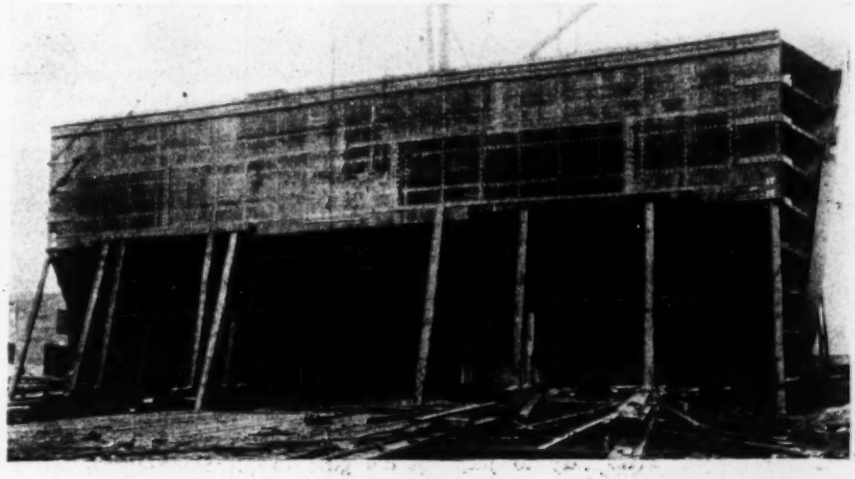


FIG. 1—415-TON FLOATING GATE FOR BROOKLYN DRY DOCK AFTER MISHAP IN LAUNCHING
Temporary blocking has been placed preparatory to jacking operations.

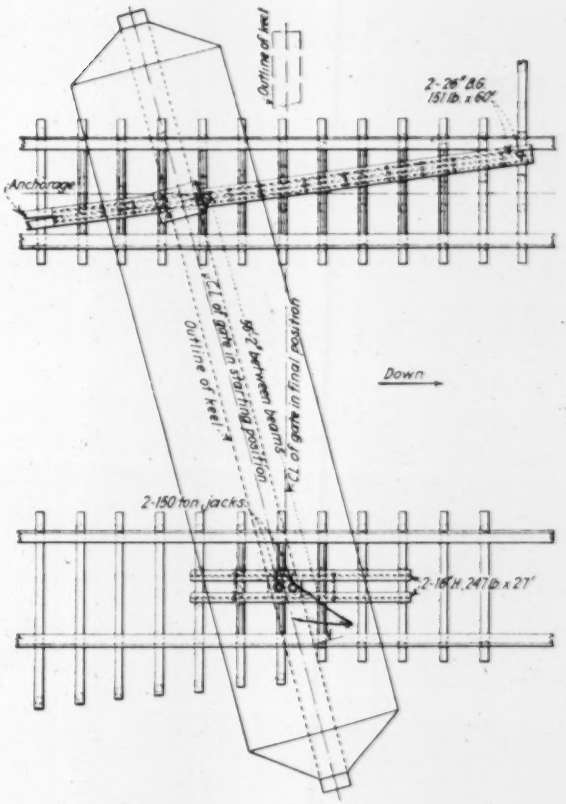


FIG. 2—POSITION OF GATE BEFORE JACKING AND SKIDDING COMMENCED
Temporary beams used for skidding shown in place.

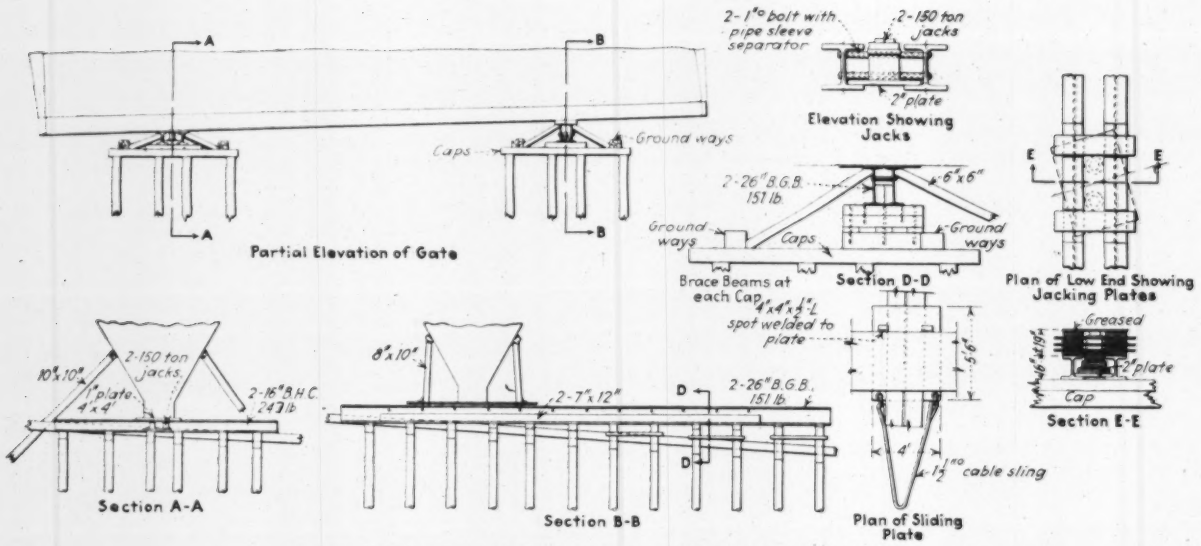


FIG. 3—DETAILS OF JACKING AND SKIDDING ARRANGEMENTS

to an electric winch. To prevent the 26-in. beams from sliding between the supporting blocks and the lower plate the inshore ends of these beams were well shored. By this means the high end was slid 16 ft. down the ways. Once started, the motion was constant. The starting coefficient of friction was estimated as 0.25, while when in motion it was estimated as 0.20.

In order to maintain the gate in an upright position during moving, spur braces were placed as shown in Fig. 5. These braces rested on and were fast to the top sliding plate. When the gate was moved, the braces, which would have a tendency to be wedged by the rotation of the gate, were left out and the gate was held in an upright position by wedging up the braces which were loosened by the motion of the gate.

The pivot at the low end, made of the two plates separated by graphite and grease, performed their purpose well, the motion being very nearly angular and with only a slight translatory motion in a direction parallel to the longitudinal axis of the gate and toward the pivot.

This brought the gate once more perpendicular to the two sets of ground ways and in a level position, but resting on the two sets of beams, and its center of gravity 1 ft. 10 in. off the center of the two sets of ground ways.

Replacing Sliding Ways—Work was then started to build the sliding ways and cradle under the gate (Fig. 5). The cradle was designed so that in case one side should be freed and the cradle held by one end, then the horizontal twisting moment resulting from the horizontal component of the weight of the gate would be transferred to the ribbands and thus to the ground ways, preventing in this manner the sliding ways under the free end leaving the ground ways.

In the cradle design the full horizontal component from a declivity of $\frac{23}{32}$ in. per foot was considered without any friction loss. The effect of impact, in case after starting the gate was suddenly hung up, was taken care of by the relatively low stresses used and neglecting the decrease in the horizontal component because of the friction between ground and sliding ways. Although theoretically the coefficient of friction is independent of the width of the surface, the intensity of pressure between the sliding and ground ways was maintained nearly constant on all four by making the sliding ways 15 in. wide under the heavy end and 13 in. wide under the light end to take care of the eccentricity of the gate's position.

The two outside sliding ways were bolted at the upper end to the ground ways, while the two inside sliding ways were attached by means of single-strand slings of 8-in. ropes to blocks bolted to the ground ways. Because of interference of the temporary steel beams, it was necessary to jack up the gate to place the cross-bearing between the sliding ways. This permitted placing part of the cross-bracing, the remainder being set after the caisson was lowered to the sliding ways.

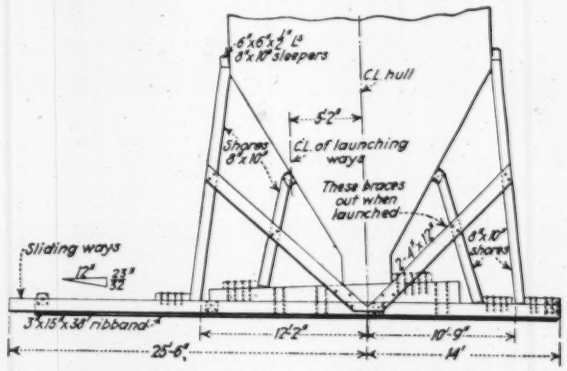


FIG. 5—END ELEVATION OF SLIDING WAYS CRADLE, SHOWING SPUR BRACING

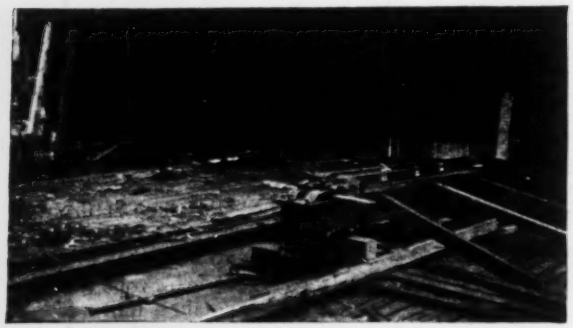


FIG. 4—SKIDDING GATE TO POSITION SQUARE WITH THE WAYS FOR RELAUNCHING

Launching—From each of the two outside sliding ways and immediately next to the bolts holding these fast to the ground ways, blocks 1 ft. 10 in. long were sawed off, thus releasing the two outside sliding ways, while the gate was held fast by the ropes on the two inside ways.

The removal of the two blocks from the outside ways left recesses in which small hydraulic jacks were inserted and a slight pressure applied to the outside sliding ways. The slings of 8-in. ropes were then cut, releasing the gate from its moorings, but the gate did not move, the starting friction being greater than the horizontal component. Applying pressure on the two jacks, the gate started and was successfully launched. It is estimated that the coefficient of friction before the gate began to move was 0.062 per cent, while at the moment it got away it was 0.045 per cent.

The gate was built for the new dry dock of the Robins Dry Dock & Repair Company plant of the Todd Shipyards Corporation by the Todd Dry Dock Engineering & Repair Company (Tebo plant), foot of 23d St., Brooklyn, N. Y. Frederic R. Harris, consulting and managing engineer on the new dock, designed the gate and directed the relaunching work. A. F. Lipari was in charge of design, and Thomas Hoyer was resident engineer on the work.

Locomotive Repair Shops: Design and Equipment

Types of Track Layout—Cranes or Transfer Tables—Shop Floors—Daylight and Shop Construction

A REVIEW of modern practice in the design and mechanical-handling equipment of locomotive repair shops was presented at the annual meeting of the American Railway Engineering Association by the committee on shops and locomotive terminals, and some notes from this report are given here.

Locomotive repair shops are of two types, having longitudinal and transverse tracks respectively. The selection depends primarily on three considerations: (1) personal preference, (2) property restrictions, (3) possibility of radical change in length of engines. Replies to a questionnaire showed twenty railroads favoring the transverse type and six the longitudinal type of shop, with tracks spaced 22 to 28 ft. c. to c. in the former (majority 25 ft.) and 22 to 30 ft. for the latter (majority 30 ft.). For the boiler work, 23 roads preferred a separate shop on account of the noise, and seventeen favored having it in the main building on account of crane service and convenience of supervision. For raising the engines to remove and replace wheels, 26 favored the overhead crane on account of convenience, flexibility and speed, and one favored a jacking hoist on account of its low first cost. Repair pits are usually sloped longitudinally and have a crowned bottom giving a depth of 2½ ft. at the upper end and 3 ft. at the lower end. One road replying to the questionnaire does not favor pits in the erecting shop.

Overhead cranes for shifting the engines are preferred by 24 roads on account of efficiency, flexibility, keeping all work inside the shop and eliminating numerous doors, thus making it easier to heat and maintain the building. Three prefer transfer tables, whereas five of the 24 would like to have both cranes and transfer tables. For paving the erecting bay, 21 roads preferred wood block or concrete, four preferred asphalt mastic on concrete and two preferred concrete. For the machinery bay, the figures were 20, 5 and 2 respectively. For the boiler shop, sixteen preferred wood on concrete, two preferred concrete and two preferred cinders or gravel. Vitrified brick is used in front of furnaces, such as the annealing furnaces in boiler shops.

Features of Repair Shops—In modern longitudinal shops, attention is called to the increased spacing of repair tracks, wider and higher erecting and machine bays, and increased capacity of cranes; in transverse shops, the width and height of erecting bay and the capacity of cranes. In both types a feature of considerable importance is the increase of shop area provided for machine shop purposes. Increase in size of parts of locomotives alters the procedure in laying out a modern shop, the parts being so much heavier that it is now necessary to provide more mechanical means and lifting devices. In view of increased labor rates, all practicable means of eliminating manual labor should be utilized. Probably the greatest step in this direction is the overhead traveling crane; other devices are portable and fixed individual jib cranes, also trucks, tractors and trailers for material handling.

Several recent large shops are of the transverse type. A fundamental advantage of this type is the right-angle movement resulting from the cranes operating crossways of the tracks, which permits a better distribution of material and work between the engines and the machine tools; it also allows a better grouping of supervisory forces and workmen. The longitudinal shop is better adapted to the "station to station" system of repairs, and can be better adapted to radical change in length of locomotives.

In modern longitudinal shops, the erecting bay varies in width from 90 to 100 ft., with three repair tracks spaced 30 ft. c. to c. The track pits extend practically the full length of the shop. Crane equipment in the erecting bay consists of two cranes of sufficient capacity and height to move engines down the shop when suspended between others on the tracks. In addition, lighter cranes on lower runways are provided for stripping and messenger service; these may be 15-ton cranes spanning the erecting bay or traveling jib cranes on each line of columns.

Shop Building Design—In designing the buildings for locomotive repair shops, the following conditions should be considered as good practice. The cross-section of the building is determined by the crane heights and loadings. As the wheel loads of the heavy cranes are much greater than those of the heaviest locomotives, careful assumptions must be made of loadings and side and end thrusts, to provide a structure which is both safe and economical. Attention should be given to the foundation designs and to the anchoring of structures to resist wind loads and side thrusts of cranes.

Ample natural light is of considerable importance. The varying heights of the different bays give an excellent opportunity to use continuous steel sash between roofs of different levels. These can be supplemented by skylights over the erecting bay and longitudinal sawtooth lighting over the lower bays. An alternative to these roof lights can be made by building alternate roof panels on the top and bottom chords of the trusses, with continuous top-hung steel sash alongside of the trusses.

Side and end walls of brick, anchored to the steel work, with steel sash grouped in large units, provide the most satisfactory inclosure of the building. All movable sash and ventilating panels should be glazed with wire glass; fixed sections of side-wall sash may be glazed with clear or plain ribbed glass. Glare and direct sun rays should be guarded against, and glass is now made which kills the glare and improves the diffusion of light inside the building.

Floors of wood block on a concrete base have proved satisfactory for heavy shop service. In some departments, floors of asphalt block or cement finish can be used. Swinging wood doors for tracks and other large openings are the most economical and quickest in operation. Where these have been unsatisfactory, it has been generally due to poor design.

Effect of Percolating Water on Concrete Dams

Observation of Seepage Through West Coast Structures Shows That Marked Leaching Action Is Going On in a Number of Instances and Indicates That Impermeable Construction Must Be Sought

By N. A. Bowers

Pacific Coast Editor, Engineering News-Record, San Francisco

PERCOLATING water may leach out the concrete body of a dam to such an extent that the usefulness of the structure may be ultimately destroyed. This is the prominent conclusion from the writer's observations on dams along the Pacific Slope and study of seepage waters. It does not mean that existing structures are in immediate danger, for the process of deterioration is slow, far too slow to bring about any sudden emergency. But the effects that may be observed, especially in the case of poor concrete, are serious enough to warrant careful study. All concerned need to look to the future, engineers as well as the municipalities, power companies and irrigation districts that depend on the continued service of dams.

Singling out certain past deficiencies can serve a constructive purpose, the writer believes, by pointing out pitfalls which should be avoided in future construction. It is clear that many factors are involved in the problem at issue, among them quality of materials, proportioning, water-cement ratio and methods of placing. But assuming proper materials and methods, there are more safeguards than are now used that could aid in assuring the desired results. A great advance in construction practice, for example, would be made by the adoption of some simple and effective permeability test to supplement the normal strength tests in judging of concrete mixture and quality.

In the following notes and conclusions, based on study of a large number of hydraulic structures, specific citations have been avoided, and the few given are intended as illustrations rather than as evidence.

Two Kinds of Percolation

Water coming through concrete structures may be passing through cracks or it may be seeping through the mass of the concrete itself. Cracks afford pathways by which water may penetrate concrete whose impermeability within the mass itself would effectively resist percolation. In poor concrete, on the other hand, seepage passes through pores and interstices within the mass and thus comes in contact with and passes between particles that should be tightly cemented together.

Fortunately it is unnecessary to distinguish, in collecting water samples for analysis, between leakage through cracks and seepage through the mass. The important question is whether the water coming through, by whatever route, is carrying away in suspension or in solution substances essential to the permanent serviceability of the concrete.

Fundamentally the chemical processes that attend percolation and absorption are simple. The calcium of the compounds in the cement is ever ready to form a solution of calcium hydrate, in which condition the calcium has a very high affinity for gases. The most frequent gas combination is with carbon dioxide, which is absorbed into the water from the air, resulting in calcium carbonate, the white incrustation so frequently found on concrete structures through which seepage has occurred. This cycle of reactions through the formation of calcium hydrate to the combination in the form of calcium carbonate incrustation requires the presence of moisture, the supply of which is generally from seepage.

Analysis of Seepage Water

Chemical analyses to determine what the seepage water contains are being made with increasing frequency now that the importance of the subject is recognized. In one case water samples from the inspection gallery of a dam were found to contain ten times the amount of solids present in the reservoir water. Clear seepage water has been known to carry solid content as high as 30 times the content of the same solids present in the water before the absorption occurred (*Engineering News-Record*, May 17, 1928, p. 784), and while the solids in that particular instance were absorbed from foundation material and not from concrete, the case shows that seepage may be clear and yet be highly charged with matter in solution.

One of the most significant results of recent tests on seepage is that in some cases as much as 1.8 times the solid content that can be carried in a saturated solution was found in water seeping from a concrete structure subject to water pressure. This, with the fact that very heavy deposition usually occurs immediately after the water escapes from pressure, suggests that pressure may be the cause of supersaturation.

In the accompanying illustration there may be seen calcium carbonate deposits *fourteen inches thick* on the stairway of an inspection gallery in a concrete dam. This gallery is damp and cold, and evaporation would be relatively low. Yet the deposition there is far greater

CALCIUM CARBONATE DEPOSITS IN AN INSPECTION GALLERY

than that which occurs from this same water after its escape into the air and sunshine, where much more rapid evaporation occurs.

Field observations suggest that release from pressure often leaves seepage with an excess of solid content which must quickly be dropped. That is, deposition may occur in cracks or in pores within the concrete because the path of the leakage is so tortuous that friction dissipates the pressure, whereupon the solids in solution must be reduced from the supersaturated condition to the saturation point. On this theory deposition within the concrete mass itself, which hardly could be attributed to evaporation, is readily explained. It is observed that small leaks often seal themselves.

Self-Sealing and Continued Seepage

When percolation through pores does not decrease and eventually stop, there is trouble ahead. Unfortunately the continuous leaching out of any of the elements which make up concrete will in time bring about serious deterioration. The situation is the more dangerous from the fact that the concrete above water level and that on the downstream face may remain sound, and thus give a false impression of security, while concrete within the structure through which the infiltration and seeping are going on may be extensively affected.

In one instance a dam with concrete in excellent condition on the top and downstream face had the lower portion of the upstream face so badly deteriorated that a workman using hand tools easily completed in two days a 6x6-in. groove 225 ft. long which was needed for a minor change in design. The engineer in charge of this work had expected to be obliged to use compressed air and the usual rock-drilling equipment to cut this groove, and it was a great surprise to him to find the concrete so badly deteriorated that such tools were not needed. This dam was built seventeen years ago; its downstream face is thickly coated with calcium carbonate.

Defects of Placement

Field observations indicate that the weak zones or danger zones in concrete dams, so far as percolation is concerned, are the layers or joints between successive pours. Laitance may be present on the top of one pour, or the bottom of the next succeeding pour may have been too wet and water may have leaked through the forms, carrying away the cement and leaving pockets containing only coarse aggregate. These are only two of the numerous risks involved in construction joints. More often than not even the poorest construction will show a large part of the concrete highly resistant to the percolation that so readily comes through the joints.

In other words, the methods of placement rather than the quality of the concrete itself are more frequently the cause of percolation through hydraulic structures. Laboratory tests can do no more than give assurance as to the quality of the concrete, and there yet remains the highly important matter of getting the mix properly into the forms. Because weaknesses due to laxity in methods of placement are the most frequent causes of poor concrete, it would be unwise to stress the need for more accurate laboratory control without a word of warning as to the fundamental need for constant, expert inspection while pouring is under way. It is only after making the assumption that concrete placing will be handled expertly that attention may be properly turned to progress yet to be made in present control-laboratory practice.

Comparing results and analyzing conditions that may be observed now in a representative list of concrete dams which have been in service on the Pacific Slope for five years or more suggests the need for more effective attention to impermeability in concrete control. The almost invariable practice has been to work out aggregate proportions with a view to maximum density and then to judge the results by strength, at least in so far as laboratory control is concerned. Unfortunately, actual experience with the structures has not always confirmed the expectation of high impermeability based on high strength tests. High strength alone is not proof of correspondingly high resistance to seepage.

For example, a large dam built five years ago under the most careful supervision in the control laboratory has constantly leaked about 2 sec.-ft. since it was put into service. Strength was the criterion used in proportioning aggregate. The 28-day strength average was above 3,000 lb. per sq.in., but the essential requirements for impermeability were not met.

Supplementing observations of conditions in the dams themselves with the opinions now commonly expressed by designers and builders, there is found a widespread demand for field laboratory tests that will give some direct evidence of permeability. This is needed as a supplement to the customary compression tests. To meet this demand the new tests must be applicable in a field laboratory—no plan would be acceptable that required sending the materials to a distant laboratory where water, atmospheric conditions and personnel all are different.

Uniform Test Methods Needed

Permeability tests are already beginning to come into use in many laboratories operated to control concrete proportioning, and the practice is rapidly extending as the importance of such tests is becoming more apparent. At present, however, the tests are not uniform, for the most part being patterned after the ideas of the individual in charge. A recent check on methods of making permeability tests in control laboratories showed almost as many methods as there were laboratories using them.

A standardized form for permeability tests is now an urgent need. Until practicable standard methods are available, the best results cannot be expected either in extending the use of this aid to accurate control or in making the comparisons of results that will so greatly increase its usefulness.

Constructive suggestions as to a standardized form for permeability tests, applicable in field laboratories, such as may be expected from the A.S.T.M. committee now working on this general subject, would be a real contribution to the construction industry and would be a material advance toward that ultimate ideal of structures that have, as a whole, "permanent impermeability."

Lochaber Tunnel Lining

In the caption of the picture of the interior of the pressure tunnel of the Lochaber hydro-electric power plant, shown on p. 13 of the July 4, 1929, issue of *Engineering News-Record*, it was stated that precast liners were used for lining part of the tunnel. This statement is incorrect. A study of the use of such liners was made, but they were not adopted. The appearance of separate lining slabs in the picture is due to the method of placing concrete at the end of the steel forms used in the lining.

Underpinning 17-Story Building Founded on Old Pneumatic Caissons Proves Difficult Task

Provision for New Central Union Vault Requires Replacing Massive Brick Piers With Steel Columns in Cramped Quarters—Condition of Old Caissons Revealed—Watertight Joints Built Between Old Wall Piers

By George W. Glick
Moran & Proctor, Consulting Engineers, New York

WHEN the Central Union Trust Company bought the old Manhattan Life Building at 66 Broadway, New York, it was confronted with a serious alteration problem. The existing cellar did not contain an adequate amount of space for the bank's security vaults, due chiefly to the fact that the building rested on massive piers—the first in history to be sunk by the pneumatic process for the support of a building—which occupied a large part of the space needed for vaults. The engineering problems involved were: (1) removal of these piers, which rested on hardpan; (2) construction of new piers and an inclosing cofferdam wall to rock; (3) extension of the system of columns downward for 50 ft.; and (4) maintenance of the building and adjoining property in safety during the operations.

The original building was built in two sections. The first section, seventeen stories of steel frame and brick wall construction supported on cast-iron and wrought-iron columns, was built in 1893 and rested on fifteen massive circular and rectangular brick piers on concrete-filled pneumatic caissons. These were the first pneumatic caissons used for building foundations, such construction having previously been used only for bridges. Plans and specifications for this work called for all caissons to go to bedrock, about 54 ft. below street level. In 1899 a 25-ft. addition was built along the north side, resting on thirteen concrete caissons with concrete-filled timber working chambers, circular for the interior columns and rectangular for the outside columns, all sunk by air and specified to bedrock.

The actual condition and construction of the old piers, both brick and concrete, and the fact that most of them stopped short of bedrock, was revealed when the full area was excavated.

The floor level of the shallow basement of the building was at El. +10.35, just above the level of the tops of the piers (groundwater level was approximately at El. +3). The material underlying the basement floor to El. —18 was a fine sand and clay mixture, saturated with water below El. +3. Between El. +10 and rock level (El. —20 to —35) was a stratum of hardpan, upon which most of the old piers were resting.

Extensive alterations were required on the entire structure, both superstructure and substructure, so extensive that it was found advisable partly to demolish and rebuild the newer or 1899 portion of the building. The interior of the older part of the building was remodeled and a portion of the former light court was entirely inclosed. Simultaneously with the operation of reconstruction, demolishing and rebuilding, all of the old interior piers were removed and replaced with steel columns carried down to rock, in order to provide the required space for the underground security vault.

Watertight Cofferdam—The first operation in the substructure construction was to provide a permanent watertight cofferdam around the entire basement area. This was accomplished by placing reinforced-concrete joints averaging 5 ft. in thickness from groundwater level down to bedrock between the old piers around the outside wall lines. Although each of the joints presented an individual problem, the method of construction was substantially the same for all. Both flat and arch web interlocking steel sheet piling was driven in short lengths by the use of a steam hammer to seal in the hardpan overlying the rock. Fig. 6 shows a typical plan and section of one of these joints. To make the connection between the steel sheeting and masonry pier watertight, the steel sheeting was extended past the masonry and the pocket formed by the last sheet pile was sealed by jetting a pipe to rock and grouting through it as it was withdrawn. By this method the cofferdam joints were put down without the use of compressed air for a large portion of the work. The wales supporting the steel sheet piling, consisting mostly of 8x10-in. timbers, were placed from 3 to 5 ft. on centers dependent on the depths and pressures. Screw trench jacks were used as struts where possible and were left in place when the joint was concreted. Vertical keys were cut into the old piers to provide a bond between the masonry piers and the joint sections.

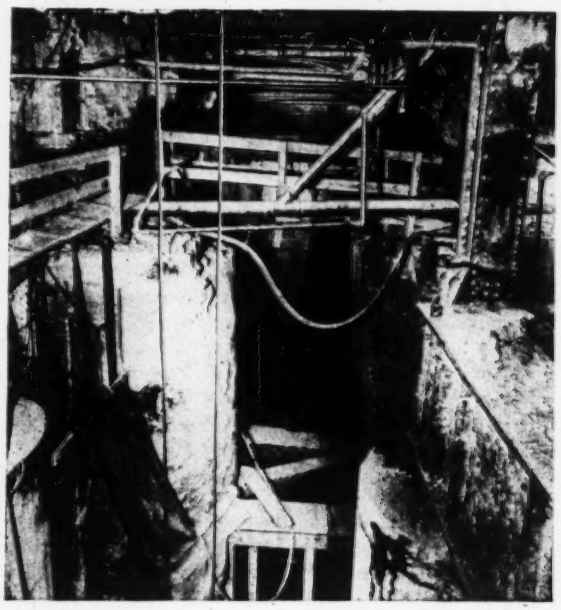


FIG. 1—UNDERPINNING OLD MANHATTAN LIFE BUILDING, NEW YORK CITY
Showing old brick caissons after excavation. Old concrete caisson and cantilever girder carrying column shown at lower right. New joint construction in background.

The excavation within the joint was carried to bedrock. Here was found the first indication that the piers, assumed to rest on rock, were actually founded on hardpan. Because of this condition it was necessary to excavate under the piers from the joints to a depth of about 4 ft. from the face of the pier and to a width approximately that of the joint, after which the pier was underpinned with concrete. Simultaneously with this operation the removal of the steel shell from the working chamber was being carried on to allow for cutting the vertical keys. With the removal of the shells it was found that the concrete filling of the working chamber was not in contact with the roof, and in order to bring this into bearing jet pipes were used to force grout into the void space between the working chamber concrete and underside of pier.

Timber forms were placed on the lot face of the joints wherever possible, being placed inside the line of wales supporting the steel sheet piling. On the outside face of the joints, where it was possible to use oversized construction, the timber wales were concreted into the joint construction. I-beam wales were used wherever oversized construction was not practicable, holes being provided through the webs of the beams to receive reinforcing steel when necessary.

In some cases of joint construction compressed air was used before rock could be reached. Such a condition developed when it was found that one of the caissons along the north wall of the 1899 addition (col. 9*A*) had not been carried to hardpan, but was resting on sand considerably above hardpan. To convert the open trench for pneumatic work, a reinforced-concrete deck was built as far down as possible, secured against blow-out and pneumatic uplift. This deck was pierced with a 30-in. steel shaft connecting the air lock and working chamber (Fig. 6). The use of compressed air complicated the work, because of the many waling pieces and long lengths of reinforcing steel which had to pass through the lock as well as through excavated material and concrete.

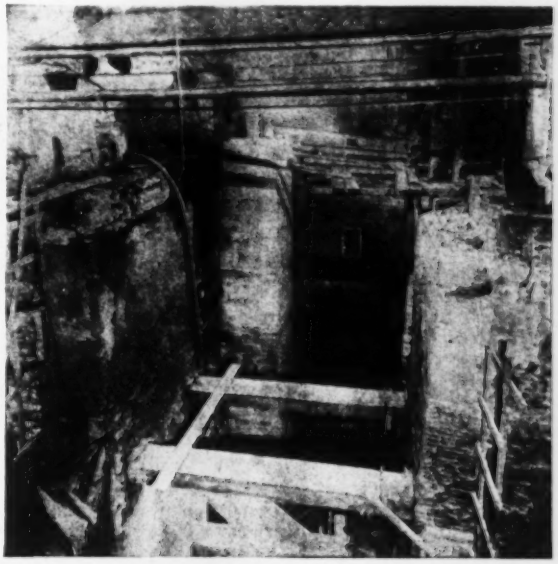


FIG. 3—OLD BRICK PIERS AND TEMPORARY UNDERPINNING PIER, MANHATTAN LIFE BUILDING
At upper right can be seen jacks under temporary column ready to take cantilever girder load off of old piers.

A special joint section was needed between cols. 28 and 8*A*, a plan of which is shown in Fig. 5. This joint was located at the northeast corner of the lot connecting brick pier *F* to concrete pier 8*A*. Between these two piers and within the limits of the new joint was located circular concrete pier 7*A*. The concrete piers had been sunk with timber cofferdam, timber deck and timber working chamber, all of which was still in place. This timber had to be removed as the new joint was being placed, interfering considerably with the bracing. The cofferdam which extended from the top of the pier down to the roof of the working chamber was removed as the excavation proceeded. Upon reaching the deck, the double layer of 12x12-in. timbers was carefully removed while steel pipe shores 8 in. in diameter were wedged in their place. The deck timbers were removed a piece at a time where possible, and concreted so as not to disturb the whole pier at one time.

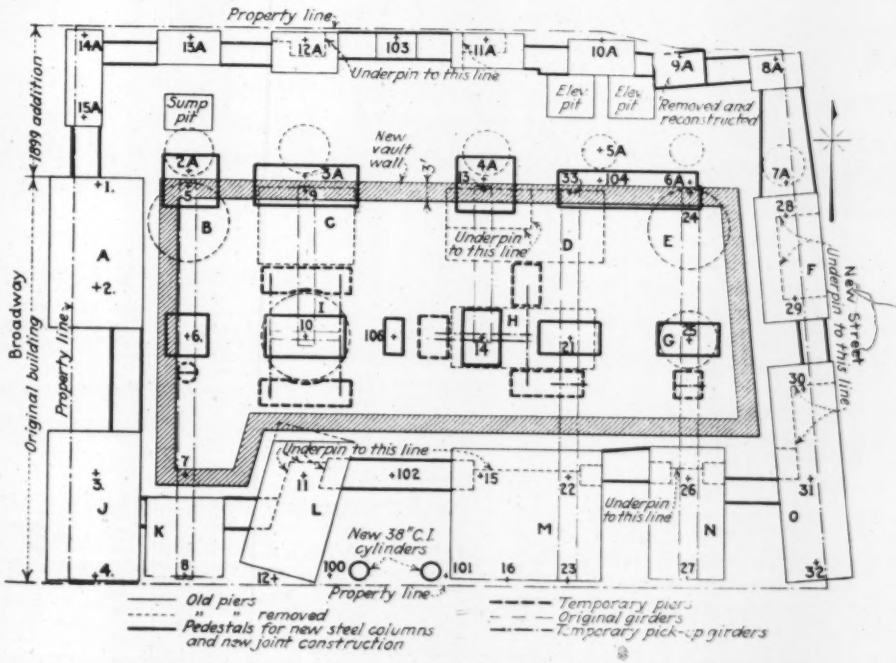


FIG. 2—GENERAL FOUNDATION PLAN, OLD MANHATTAN LIFE BUILDING, NEW YORK CITY
Old piers removed, temporary underpinning piers and permanent wall joints shown according to legend. Of the original cantilever girders, only those figuring in the underpinning operations are indicated.

Underpinning Operations—As the cofferdam was being completed the operation of temporary underpinning for some of the existing columns was undertaken. The columns for the old portion of the building were

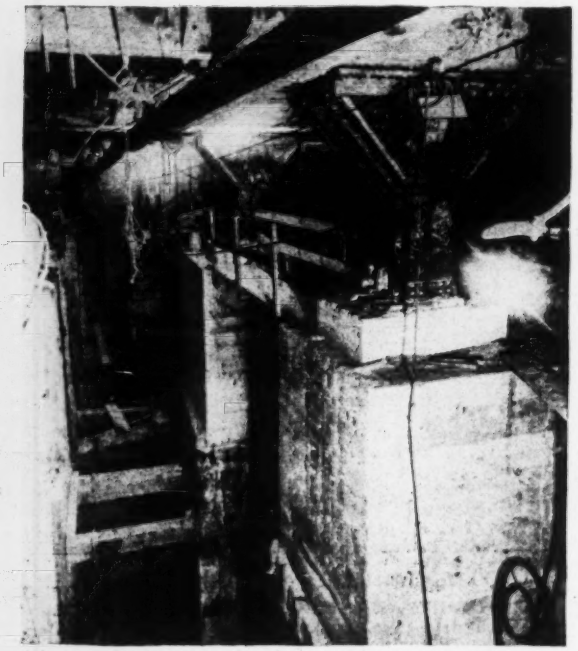


FIG. 4—CANTILEVER GIRDERS BEING CARRIED ON TEMPORARY CONCRETE PIERS
Note monorail system overhead used to remove excavated material.

carried on heavy plate girder cantilevers, most of which were continuous across the building north and south, and rested on the old piers (Fig. 2). Similarly the columns for the addition rested on plate girder cantilevers. Where cantilevers existed, new structural steel columns were inserted directly beneath the cantilever ends by cutting vertical chases in the existing piers. In other cases temporary supports were necessary to carry the column loads while the old piers were removed and the permanent steel columns placed. Concrete piers were sunk to rock to carry temporary supporting girders and cradles.

In constructing the temporary piers to carry col. 10 an open steel sheet pile cofferdam 17x25 ft. was driven around old brick pier *I* and butting against pier *C*. The entire box was excavated to approximately El. —18 (hardpan level), braced to the old pier. From this point down to the rock, four piers located at each corner were excavated and filled with concrete. From the hardpan level to the top the entire end areas of the box were filled with concrete, building paper being placed between the brick pier and the new concrete to prevent bond. Upon this set of temporary piers were placed two heavy 8-ft. plate girder cradles spanning the old pier. Three original heavy grillage girders on the old pier carrying the cantilever girders were framed into the temporary steel and the whole was lifted with hydraulic jacks. The load on this pier was given in the old records as 1,500 tons.

To support cols. 14 and 21 three temporary piers were built around old brick pier *H*. Col. 14 was carried by two girders fastened to the column itself by tap bolts, one end of these girders resting on the temporary pier to the west, the other end framed into a temporary cross-girder spanning the old pier. Col. 21 rested on cantilever girders running full length across the lot. A temporary support placed just south of the old pier under the girders carried this load. Similarly col. 25 was carried by a pier sunk south of the original pier.

Col. 6 had been founded on timber piling, driven to hardpan and capped with reinforced concrete. In order to support this column temporarily, a 42-in. steel cylinder was sunk to rock by air about 6 ft. south of the column center. When the excavation was complete this cylinder was filled with concrete and capped with a steel billet and I-beam grillage upon which the cantilever girders were raised with wedges and hydraulic jacks.

By the time the transfer of the column loads to temporary supports had been completed the outer cofferdam was sealed and the excavation within the lot was well under way. As this work proceeded the old brick caissons which had supported cols. 10, 14 and 21 were removed and a system of temporary cross-lot bracing was introduced. This bracing system consisted of 12x12-in. timbers and was placed in three horizontal layers as shown in Fig. 8. The entire general excavation was carried to approximately El. —29, requiring the underpinning of a number of interior caissons down to rock level. This was accomplished by sealing under each caisson in short sections and underpinning with concrete. It was also necessary to underpin most of the old caissons forming the cofferdam wall, but before this was undertaken the steel shell of the working chamber was entirely removed on the inside face, thus disclosing many interesting features of these earlier pneumatic caissons.

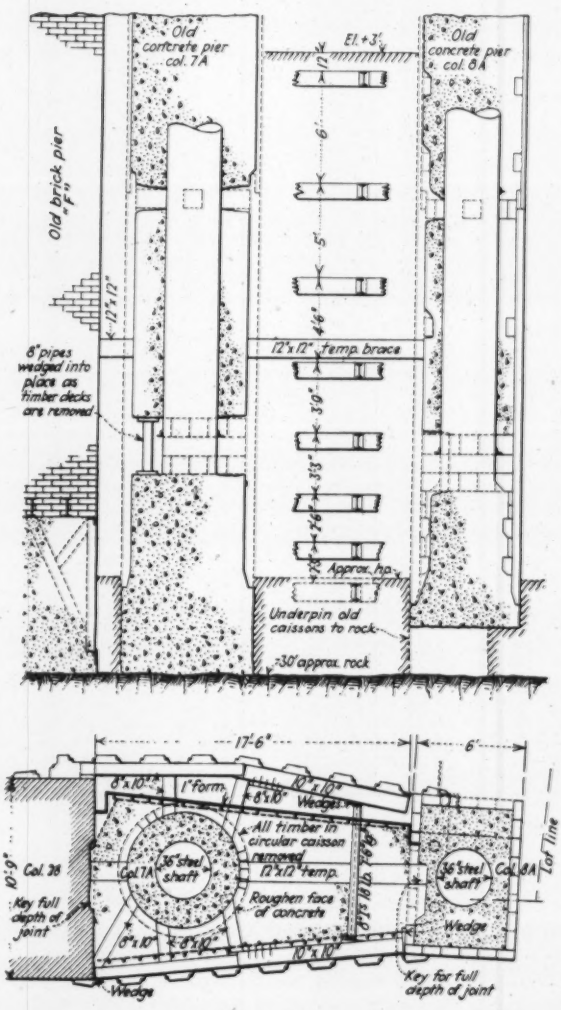


FIG. 5—PLAN AND SECTION OF SPECIAL JOINT INCLOSING COLUMNS 7A AND 8A

Condition of Old Caissons—The steel caissons were in reality that part of the pier now known as the working chamber and consisted of ½-in. steel plates stiffened with 6x6-in. vertical angles and knee braces. The deck was a ⅜-in. steel plate attached to 7-in. steel bulb angles placed horizontally between the knee braces, while above the deck I-beams were placed to transfer the weight of the pier across the working chamber roof to the cutting edges. Extending from the working chamber up through the solid brick pier was a 4-ft. circular steel shaft. After the caisson had been landed in its final position this working chamber and the steel shaft had been filled with concrete. None of the caissons rested on rock, but stopped in hardpan from 1 to 5 ft. short of rock.

An account of these pioneer caissons appearing in the *Engineering News*, Dec. 7, 1893, states that all went to rock. Old records indicate that at that time New York hardpan was viewed as equivalent to rock in bearing value, since it was considered stronger than the concrete then in use. The allowable working stress for concrete in the early stages of development was only 150 lb. per sq.in., less than the allowable bearing value of foundations on hardpan at that time.

The old concrete was far inferior to that used today, but justified the working stress allowed at the time. There were large pockets where no concrete had been placed near the working chamber roofs (Fig. 7), which were filled with concrete and grouted immediately on uncovering. Portions of the old concrete found to have been poorly mixed or containing little cement were removed and replaced with new concrete. Apparently the use of vent pipes and grouting the upper portion of the working chamber, as is the modern custom, was then an unknown development.

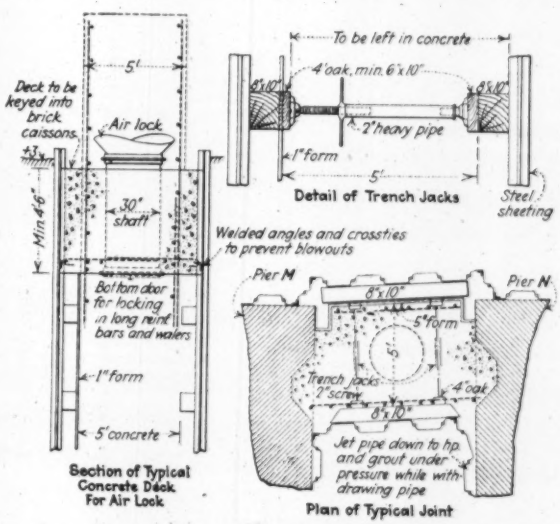


FIG. 6—PLAN OF TYPICAL JOINT AND SECTION OF AIR LOCK FOR JOINT CONSTRUCTION

The brick piers over the working chambers showed a far higher quality of workmanship, being built of hand-burned brick well laid in portland-cement mortar, and were difficult to remove.

The concreted caissons in the 1899 addition of the building were of entirely different character and represented a six-year development in pneumatic caisson construction. These caissons consisted of heavy timber working chambers filled with concrete, solid timber decks, 24 in. thick, and concrete piers above the decks, built within timber cofferdams. In the construction of the new basement it was necessary to remove the timber cofferdam, deck and timber working chambers of these caissons. The cofferdam surrounding the concrete pier was of 3-in. material and was removed at the same time the general excavation was being carried down, but the complicated problem of removing the deck and working chamber required slow and careful work.

As was the case in the brick caissons, the original concrete in the working chambers had been poured through the shaft without vent or grout pipes to insure a contact of the working chamber concrete with the deck. Thus the main portion of the roof was wholly unsupported other than by the timber working chamber walls and by

FIG. 7—CONDITION OF OLD CAISSONS, SHOWING INSUFFICIENT AND POOR QUALITY CONCRETE IN WORKING CHAMBERS

the cone of concrete formed directly beneath the shaft. It was unnecessary to grout under the roof, and the intervening space was filled with concrete as the roof timbers were removed. The working stresses on the concrete of the piers were only slightly higher than those used in the original building. These caissons all stopped short of the rock and rested on hardpan, one previously mentioned resting entirely on sand. All of these caissons are now underpinned to rock.

The structural steel and timber in the various caissons showed very few signs of deterioration after 30 years in place. The structural steel in the original caissons had been scarcely pitted through rust action, and being practically isolated from the structure, showed no signs of electrolysis.

Permanent Columns—After the loads were picked up by the temporary underpinning and the old columns were removed with the general excavation, concrete footings were poured on rock to carry the permanent columns. These new columns were designed with brackets close to the foot under which 300-ton hydraulic jacks were placed, which were used in transferring the loads from the temporary supports. All columns were designed to carry the existing loads with a length equal to the total basement height, which permitted the transfer of column loads without the introduction of additional steel framing for bracing purposes. After the grillages with their billets were in place the columns were carefully set to exact position, plumbed and wedged tight.

Vault Wall and Waterproofing—A trench was dug into the rock to carry the vault wall. An underdrainage system of broken rock was laid over the exposed rock floor, providing drainage to a sump. A protecting course of

concrete was laid over the drainage system, and upon this floor asphalt membrane waterproofing was laid to insure a watertight vault. Waterproofing was also placed in the trench dug to receive the vault walls, tied in with the vault floor waterproofing. Upon the membrane waterproofing was laid a 12-in. concrete slab to serve as a base for the finished floor.

As soon as the cofferdam surrounding the basement had been completed and the basement floors installed, the entire inside surface of all exterior walls was chipped to provide a secure bond and then coated with cement waterproofing. This waterproofing served both to protect the basement against moisture and to provide a finish for the walls and a hard durable wearing surface for the floors.

The structural steel floor system was installed and reinforced-concrete arches were placed over the entire area, except where the security vault wall passed through the floor. The vault walls, which were 3 ft. in thickness and heavily reinforced, were then installed. After these walls had properly aged, the cross-lot bracing system was removed and all the lateral pressure from the cofferdam was taken through the basement floor systems, designed to provide this support.

Plant Layout—Providing suitable and efficient equipment for handling materials was a problem to which the foundation contractor gave careful thought, since the building fronts on two of lower Manhattan's busiest streets, making the removal of the old material and the bringing in of new material extremely difficult. Excavation from the cofferdam joint sections was placed in buckets and dumped into cars operating on a narrow-gage track located on the basement floor of the older building. These cars took the excavated material to the sidewalk vault area in New St., where it was hoisted into trucks by a power derrick.

On account of the cramped quarters, the concrete plant was placed in the corner at the south side of the basement of the older building. Concrete materials were dumped into the sidewalk vault on New St. and raised from the vault to the mixer by a chain bucket conveyor.

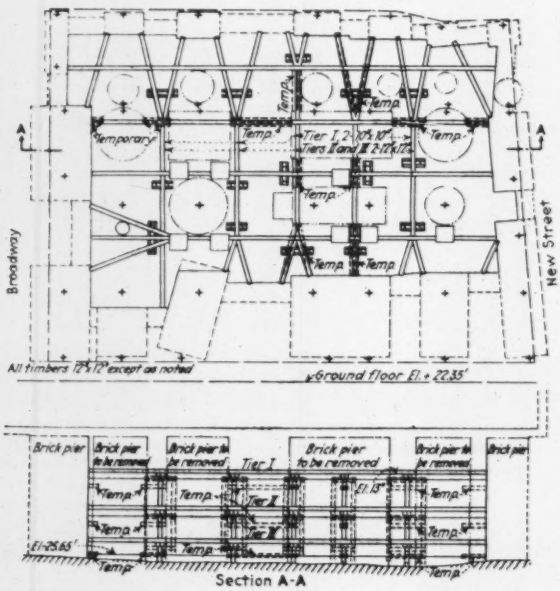


FIG. 8—PLAN AND SECTION OF TIMBER BRACING SYSTEM

The concrete from the mixer was distributed by cars on the narrow-gage tracks and by wheelbarrows.

When the general excavation commenced, it was necessary to remove the narrow-gage system, which was replaced by two monorails hung from the girders of the original building and the addition (Fig. 4). The narrow-gage track was again used for the general excavation at the lower levels.

Cross & Cross, architects, were in charge of the entire operation. Moran & Proctor were consulting engineers on the foundation work, and H. G. Balcom was the consulting engineer on structural steel. Marc Eidlitz & Son, Inc., was general contractor, and the underpinning and foundation work was done by the Foundation Company. The structural steel, both temporary and permanent, was fabricated and erected by Post & McCord, Inc.

Circulation Studies at Tri-Cities Activated-Sludge Plant

TO DETERMINE whether spiral flow that would improve circulation could be secured thereby, the ridge-and-furrow bottoms of two of the aeration tanks at the Pasadena (Calif.) activated-sludge sewage-works were removed and a double row of filtros plates substituted. These plates were placed on the bottom of the tanks along one side, and corners at the bottom on the opposite sides were rounded. Sewage was then treated in these tanks and comparative studies were made with sewage in adjacent tanks, with regard both to the amount of air used and to the results obtained. The amount of air required for the two tanks which had been modified in design was the same as for the adjacent tanks using ridge-and-furrow design, and laboratory tests on samples of the sewage indicated that the results were practically the same.

If the tanks as first built had been wider and shallower and if the corner construction had been such as to accommodate the spiral flow of sewage to better advantage, the results might have been different, in the opinion of W. C. Earle, city engineer, who directed the work. The tests showed, however, that it was not practicable to improve materially the operation of the plant by such reconstruction of the tank bottoms as would be feasible in this plant.

A description of the Tri-Cities activated-sludge plant, to which Pasadena is the largest contributor, was published in *Engineering News-Record*, Sept. 27, 1928, p. 469.

Navy Making Survey for Floating Airports in the Atlantic

A survey to determine the feasibility of anchoring artificial islands in the Atlantic for the landing of airplanes, to make possible the establishment of transatlantic airplane services in relay hops, is being made by the Navy survey ship "Hannibal," according to an announcement by the U. S. Navy Department. The survey is undertaken for a commercial company proposing to establish such a service.

The "Hannibal," the statement said, now is surveying an area about half way between New York and Bermuda for a seadrome anchorage.

A description of a proposed floating airport was given in *Engineering News-Record*, May 16, 1929, p. 794.

Supplementary Water Supply for Kingsport, Tenn.

High-Head Gravity Supply Used to Pump Combined Supply After Treatment— New Supply From River

By H. F. Wiedeman
Of Wiedeman & Singleton, Civil Engineers, Atlanta, Ga.

TO KEEP pace with the growth of Kingsport, an industrial city of 18,000 population in eastern Tennessee, an additional water supply has been introduced which utilizes the high head of the original gravity supply for power to pump both the old and the new supplies after filtration. The original supply is impounded in a 175,000,000 gal. (175 m.g.) reservoir, about 6 miles from the city, with a drainage area of approximately 2 square miles. The water surface in the reservoir is at El. 1,832, while the business section of the city is at El. 1,210, giving a static head of 622 ft. on the distribution system. The drainage area is uninhabited. Originally raw water was taken directly from the reservoir to the system through a 10-in. cast-iron supply main. Objectionable color, and at times turbidity, necessitated the construction of a filtration plant, which was later located directly below the storage dam.

The original water-works was built by the Kingsport Utilities Company and was operated by it until 1926, when it was bought by the city. In 1925 and again in 1926 water shortage was averted only by curtailing industrial and domestic use. A thorough study showed that a sufficient additional gravity supply could not be obtained from highland sources without prohibitive expense and it was therefore decided to supplement the gravity supply with a pumped supply from the South Fork of the Holston River, which has a drainage area of 2,000 square miles and a minimum flow at Kingsport of approximately 500 sec.-ft. The stream receives a considerable amount of pollution from the sewage of several cities above Kingsport, and also some industrial wastes, but analyses continued over a considerable period indicate that the effect of this pollution at Kingsport is negligible. This fact has been demonstrated by the operation of a 500,000 gal. daily (0.5 m.g.d.) temporary filtration plant which was installed in the summer of 1928 to prevent a water shortage.

WATER-PURIFICATION PLANT, KINGSPORT, TENN. Aerator, mixing chamber and coagulation basins back of filter house. Clear-water well under filters. Hydraulic turbine on high-head gravity supply main draws from clear-water well and delivers filtered water to town. Old supply passes from turbine to filters, which also treat new supply pumped to filters from river.

HOLSTON RIVER PUMPING STATION, KINGSPORT Force main extends up the hill and through tunnel and on to filtration plant. Motor-driven centrifugal pumps are used.

The design of the new works necessarily required that the use of the existing gravity supply be continued and that it be used to its maximum capacity, not only because of the valuable gravity head but also because the water was very soft and if mixed with the river water, which has a total hardness of 80 parts per million, the hardness of the resulting water would be materially lower than the river water. This might have been accomplished by retaining the existing filtration plant and mixing the two waters in the distribution system, but since that plant was difficult and expensive to operate because of its almost inaccessible location and since centralized operation was less expensive and permitted better control, it was decided to abandon the existing filter plant and centralize filtration operations.

The river or low-service pumping plant for the new supply consists of three horizontal motor-driven centrifugal pumps of 700, 1,000 and 1,400 gal. per minute (g.p.m.) capacity each. The pumping station is designed to take a 30-ft. rise in the river. The pumps have a maximum suction lift of 10 ft. and are primed and operated from the filtration plant, which is about ¼ mile distant. A 16-in. force main leads from the low-service pumps to the purification works. These include an aerator, a gravity mixing chamber, a coagulating basin with an eight-hour theoretical retention period at the 2-m.g.d. rate and two 1-m.g.d. filter units. Aeration before coagulation is provided by fourteen nozzles, of the Sacramento type, mounted on the coagulation basin. A 0.4-m.g. clear well is located under the filters. High-service pumps are installed in the filter house.

The water from the gravity supply is passed through a hydraulic turbine directly connected to a centrifugal pump which takes its suction from the clear-water well. This turbine is designed to operate under an effective head of 380 ft., using water at the rate of 550 g.p.m. This quantity was selected because it is approximately the maximum daily draft which the supply reservoir can

maintain and also because greater discharge through the supply line is uneconomical due to loss of head by friction. The discharge from the hydraulic turbine passes to the aerators and then through the filtration plant. The average head against which the pump will operate is 225 ft. The guaranteed over-all efficiency of the unit is 49 per cent, and therefore the unit will pump to the distribution system 75 per cent of the water which passes through the turbine. While this entails a small operating loss as far as power is concerned, it is more than overcome by the decrease in operating personnel which is accomplished in centralizing the operations.

The filtration plant is located on the south side of the city and is connected to the distribution system by a 20-in. cast-iron supply line. On the north side of the city a 1-m.g. reinforced-concrete storage tank has been constructed which is connected to the distribution system by a 16-in. line. The static pressure on the distribution system varies from 60 to 125 lb. per sq.in., depending on surface elevation. Because of the rapid growth of the city, all pipe lines have been designed on a basis of a 4-m.g.d. rate.

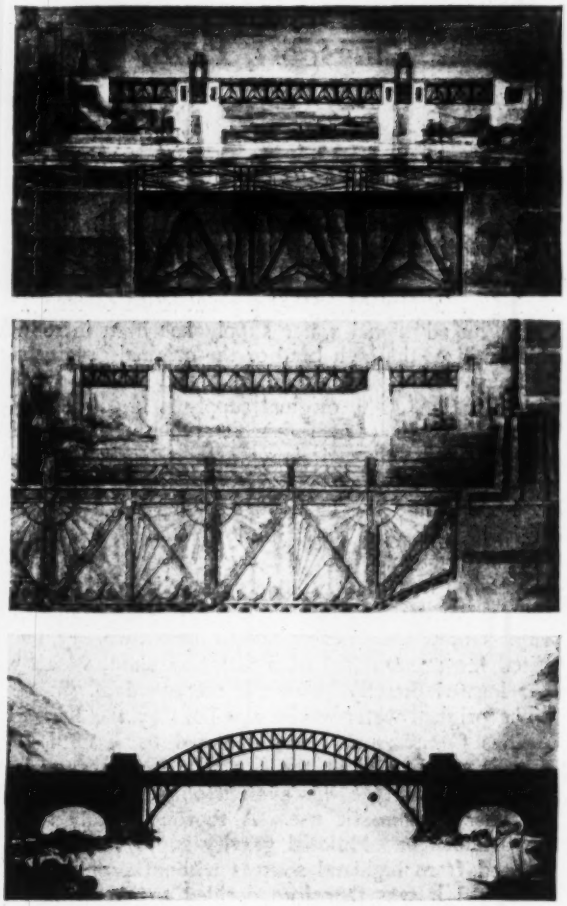
F. L. Cloud is city manager, and W. L. Webster, under whose immediate direction the work has been done, is director of public works. The writer's firm acted as designing and supervising engineers, while Edward A. Fulton acted as resident engineer in direct charge of the construction work.

Sprinklers vs. Burlap in Concrete Pipe Curing

ACCORDING to recent observation of concrete pipe making, two methods of keeping concrete pipe damp during the curing process are used: (1) covering the pipe with burlap that is wet down from time to time, and (2) spraying water with sprinklers, properly spaced, on top of the pipe sections. The burlap has the advantage that considerably less water is required to wet it down occasionally than to maintain constant sprinkling. On the other hand, time and labor cost is involved in putting the burlap in place and there is a more serious drawback in the fact that water is inclined to follow the burlap rather than the surface of the pipe, so that much of the water is led away from the lower portion of the pipe circumference to drip off the burlap at the low point between rows of pipe. In fact, when burlap is draped across rows of pipe, the under side of the pipe may become almost dry. With the spray, all water (less evaporation) which falls upon the pipe will trickle around to the under side and if the spray nozzles are properly placed some will even get inside the pipe. The continuous sprinkling system, therefore, where the cost of water permits, is believed to be the preferable method of curing.

Prizes Awarded to Students for Steel Bridge Drawings

STUDENT architectural designs to the number of 57 were submitted in the steel bridge competition held recently by the American Institute of Steel Construction in conjunction with the Beaux-Arts Institute of Design in New York City. The drawings receiving the first three prizes are reproduced herewith. The prizes were respectively $500, $250 and $100, and were awarded to designs meeting the specified conditions of the competition as regards span clearances, sidewalk and roadway widths, etc. No restrictions were placed upon the type of design or treatment, since it was desired to give full opportunity for the student's play of imagination.



PRIZE DRAWINGS IN STUDENT STEEL BRIDGE COMPETITION
In order of award with first prize drawing at top.

The first prize was awarded to M. W. Kleinman, of the University of Illinois; second prize to Pierre A. Bézy, of the University of Illinois; and third prize to W. J. Jenson, of the Atelier Hirons. In commenting upon the competition F. H. Frankland, engineer of technical service of the A.I.S.C., states: "Student architectural designs for steel bridges may not in themselves be entirely practical, yet the competition demonstrates a fact upon which we had but uncertain knowledge. It shows that there is a large field for the esthetic solution of bridge design along the lines of modern architecture. While in some cases an obvious lack of knowledge of fundamental engineering principles was indicated, the drawings did not run counter to those principles to any great extent. Furthermore, the drawings submitted showed imagination and originality, and it is felt that this proves that it is possible to stimulate constructive thinking among young architects, which it is hoped will result in a very real and significant development in bridge architecture which at the same time can be successfully used by bridge constructors. The American Institute of Steel Construction is so well satisfied with the results of this competition that it has tentatively determined to establish these contests on an annual basis."

Footwalk Suspension Bridge in Chicago Park

Two 2-In. Cables for 125-Ft. Span, With Backstays Unloaded—Stiffening Trusses Form Railings

IN A comparison of four types of spans for a 125-ft. foot bridge in Ogden Park, Chicago, the suspension type was found to be the most economical and most satisfactory, according to a paper in the *Illinois Engineer* (bulletin of the Illinois Society of Engineers), by Robert A. Black, assistant structural engineer of the South Park Commissioners. An abstract of this paper is given below:

The spandrel filled arch was too costly because of the flat rise necessary to keep down approach grades. Single-span plate girders, while reasonable in cost, were too deep to be pleasing in appearance, and two-span girders were too high in cost because of the central pier, which would require a cofferdam in construction. The bowstring arch was slightly higher in cost than the suspension bridge but would have been acceptable so far as appearance was concerned. However, after a careful study of appearance and cost and considering that foundation conditions were less desirable for an arch type, the suspension bridge was decided upon.

The bridge has a clear span of 118 ft. between abutments and 125 ft. c. to c. of towers. Its cables are 2 in. in diameter, built up around a wire center, with six strands of nineteen wires, and have a strength of 164 tons each. They pass over saddle rockers on top of the towers and have a sag of 12½ ft. Stiffening trusses are 10 ft. c. to c., which leaves a clear walkway of about 8½ ft. The deck consists of 2-in. planking on 3x10-in. joists spaced 22 in. c. to c. and resting on the channel floor beams. They are braced at intervals of 4 ft. with 2x2-in. bridging. All timber in deck and handrail was treated. The walk is protected with a wire mesh fence inside of the stiffening trusses. The suspenders are ¾-in. wire ropes secured to the channel floor beams by standard open bridge sockets and at their upper ends to malleable iron castings on the main cable by standard open wire sockets.

The superstructure design was based on the following assumptions: (1) The cable is perfectly flexible; (2) the stiffening truss is a beam of constant moment of inertia, tied at intervals throughout its length to the cable; (3) the initial curve of the cable is parabolic, and this curve remains unaltered upon application of the load; (4) the dead load is carried entirely by the cable, and the stiffening truss is stressed by live load and temperature change only; (5) the backstays are unloaded. The usual approximate theory of analysis was used—that is, the stiffening truss was considered to be so stiff that the effect of deformations due to stress, on the dimensions of the truss, could be neglected.

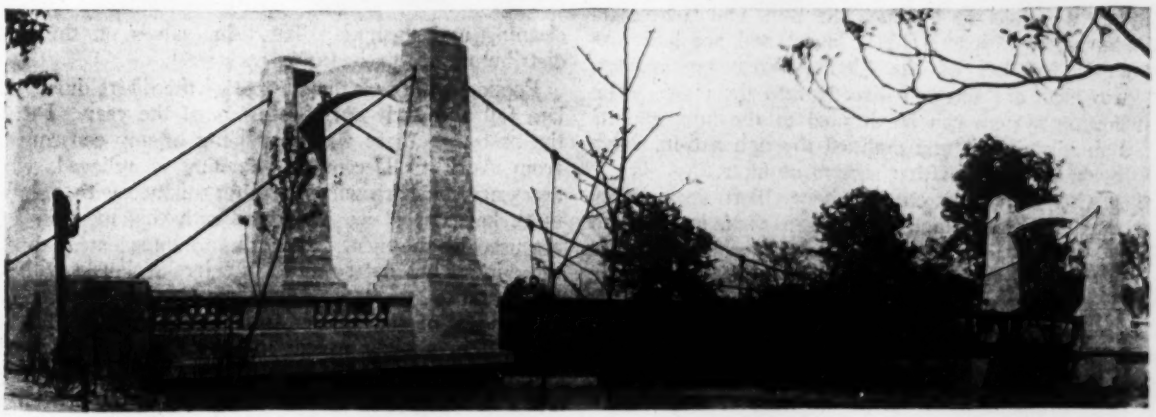
A live load of 80 lb. per sq.ft. was assumed for the design of the deck and the cables and trusses. In addition, the cables and trusses were investigated, assuming a temperature change of 50 deg. No impact was added. The wind load was taken at 25 lb. per sq.ft. of vertical projection of truss. It was found that under full live load 40 per cent of the live load is carried by the stiffening trusses and that a change of 50 deg. in temperature throws 31 per cent of the increase of stress into the trusses.

The foundations, wing walls, towers and anchorages are of concrete. The towers are tied transversely at the top, are reinforced to take bending and are carried down on piers to a spread footing which is placed about 7 ft. below water level. The foundation soil consists of stiff blue clay on which the allowable load is 1 ton per square foot. The tower piers are connected transversely with a curtain wall which is reinforced to carry the earth load of the approach. The anchorage consists simply of a block of concrete resting on the earth behind the wing walls and having a weight 100 per cent in excess of the maximum computed vertical components in the backstays. The end of the cable was secured to a closed bridge socket which had a 9-in. take-up, and this socket was then attached to a pipe sleeve mounted on 3x3x⅜-in. angle embedded in the concrete. Slots left in the anchorage until this attachment was made were then filled with concrete, casing the whole solidly. At the ground line a 4-in. pipe sleeve 33 in. long was placed around the cable and filled with mastic to prevent the entrance of water.

In erecting the superstructure, the cable drums were placed directly behind the west anchorages and the cables attached to a ⅜-in. wire rope which was carried over roller guides on the towers and down to a hand-operated winch on the east anchorage. The cables were then pulled across with this light line, the suspenders being attached at the proper points from a boat in midstream as the cable moved over. With the cables entirely across, the guide frames on the towers were removed and the cable ends belayed to the anchorages. It was then attempted to adjust the take-up on the sockets at the anchorages so that the proper sag in the cable and camber in the truss would result upon application of the dead load. It was found, however, that the actual deflection as the dead load was applied exceeded the computed deflection by about 100 per cent, due most probably to twists in the cable being straightened. For this reason further adjustment of the take-up had to be made as the work progressed.

With the cables and suspenders in place, the floor beams were hung and the trusses erected piece by piece and bolted. This work was facilitated because of the fact that the lagoon had frozen over since the cable erection. After the entire dead load was in place and the camber properly adjusted, the trusses were riveted throughout.

The general contract was let to Mackie, Thompson & Tamm, Chicago, at $19,000. The design and erection of the bridge were carried out under the supervision of Linn White, chief engineer; C. R. Hoyt, structural engineer; and George T. Donahue, general superintendent of the South Park Commissioners.



SUSPENSION BRIDGE IN OGDEN PARK, CHICAGO

Sewage-Works Operation at Worcester, Mass.—III

Third of Three Articles Summarizing Experiences, Results and Lessons of Four Years' Operation of Grit Chambers, Imhoff Tanks, Sprinkling Filters and Final Settling Tanks

By Roy S. Lanphear
Supervising Chemist of Sewage-Works, Worcester, Mass.

Dosing Tanks, Sprinkling Filters and Settling Tanks

The First and second articles dealt with preliminary and intermediate treatment. Final treatment is taken up in this, the concluding article of the series.—Editor.

THE Imhoff tank effluent at Worcester passes into the influent channel of four pairs of dosing tanks. At each end of this channel are gates whereby tank effluent can be discharged into a conduit connected with the sewage bypass previously mentioned. The rate of operation of the filters is usually maintained under 42,000,000 gal. daily (42 m.g.d.), or 3 m.g.d. per acre.

Each dosing tank is approximately 30 ft. square, holds about 37,600 gal. and discharges through a 36-in. automatically controlled siphon. The side of the tank nearest the influent channel is stepped down about 12 in. at a time so as to decrease the volume of filter influent as the head decreases. The influent enters each dosing tank through three 6-ft.x6-in. feeds, one or two of which may be cut out and the rate of operation of a section of filter decreased. The rate of filling of a dosing tank depends upon the rate of sewage flow and at a rate of 28 m.g.d. is 7¾ minutes; the time of discharge is three minutes.

The quantity of trickling filter influent is determined by small floats, installed with counters which register each filling of the tanks. It is necessary that they be clean and well oiled. They also serve as a check upon the Venturi meter records of sewage flow; with combined sewers the variation of rate of sewage flow makes difficult the prompt notice of any small error in the Venturi meter record; this check directs attention to it when comparison is made the following morning.

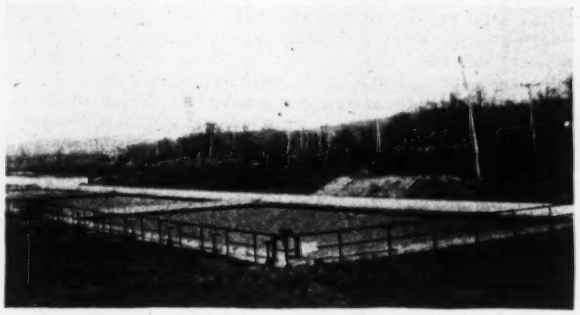
The trickling filter area is 752.5x792 ft. in size, a total area of 13.68 acres, and is divided by a concrete wall into two 752.5x396-ft. units. The distribution and collection or drainage systems divide the filter into four units, each 752.5x198 ft., or approximately 3½ acres in each unit. The main distributors are concrete pipe, extending the long way of each filter and decreasing in diameter from 54 to 15 in. The 8-in. and 6-in. cast-iron laterals are spaced 13 ft. apart and are laid just below the surface of the filter. Worcester nozzles, 1⅜-in. orifice, are screwed directly into the pipes. The distribution system can be drained to the inlet end of the main distributor and emptied through a 6-in. valve into the main drain of that section of filter.

The filter material is crushed stone, 10 ft. deep, partly local bastard granite and partly trap rock, intended to be 1¼ to 3 in. in size. The local material lacks uniformity of size, and the trap rock, while much more uniform in size, tends to be smaller than desired.

The drainage system of the filters is similar to the Fitchburg type, except that the floor is flat instead of in the form of inverts, with a pitch of 6 in. in 99 ft. to the main drain, which is on the long center line of each unit. Concrete ridges, 3 in. high, spaced 15 in. c. to c., hold 16x4x1½-in. precast cement mortar beams set on edge. These form a grid floor with 43 per cent open space. Inspection galleries are provided over the drains and at the ridge or high points of the floor halfway between the drains.

The designed rate of operation is 2 m.g. per acre per day, representing 45.9 gal. per square foot, or 4.6 gal. per cubic foot of material per day. The per capita loading is 17,286 per acre, or in other terms, there is 25.1 cu.ft. of filter per capita.

A number of operating difficulties have been encountered which will prove of interest. Removal of end nozzles quite frequently for the purpose of flushing the distribution laterals resulted in destroying the threads in the 6-in. cast-iron pipe. Special fittings, costing 65c. each, with nozzle openings have been strapped around the pipe and no further difficulty has been experienced. During 1928 an average of 10.2 nozzles were cleaned per acre per day; twelve man-hours per day cares for all nozzle cleaning and flushing. The 6-in. valves on the main distributors are flushed once each week.



FINAL SETTLING TANKS, WORCESTER SEWAGE-WORKS

After treatment by grit chambers and bar screens, Imhoff tanks with mesh screens in their outlet channels and then in sprinkling filters, Worcester sewage is given final sedimentation and then passes to the Blackstone River.

Pooling occurs on the surface of the filters during the late fall and early spring seasons of the year. During the past year there was no pooling of any consequence from April to December. Pooling is relieved, when necessary, by harrowing the filter surface with a spike-tooth harrow; if ice interferes with this method, bars are used by the men. Ice forms to some extent during the winter, but not so as to interfere seriously with filter operation.

Removal of end nozzles for flushing purposes has not resulted in pooling except in the case of those on the last two or three lateral distributors. The last row of nozzles in each filter has been equipped with special fittings so that these nozzles can also be removed

frequently. The suspended matter or sludge in the distribution system carries to these particular nozzles in sufficient quantity to foul the surface of the stone. Consideration has been given to a number of methods of taking care of this condition.

Uniformity of distribution of filter influent is essential for its maximum purification. The stone was left high between the lateral distributors on all four sections of filter. The excess stone has been removed from one section of filter, using a bucket loader and tipcarts. The distribution is excellent on this one area at all times. On the three other areas distribution during pooling season is a sad-appearing spectacle, nozzle clogging is increased and the few frozen nozzles in winter are usually the result of this condition. Lack of funds has prevented the completion of this work. Poor distribution can be entirely eliminated and nozzle clogging materially reduced.

Removal of excess top stone from one filter in June, 1927, following two years of operation, showed that the stone was much cleaner 12 in. below the surface than it was in the top 12 in. Examination of filter medium for animal life in February, 1928, previous to spring unloading, showed that the stone was dirty to a depth of from 24 to 30 in. Entire absence of pooling during the summer of 1928 indicated that spring unloading of the filters was successful.

The filter effluent drains and the dry galleries have been cleaned each winter. Water is available in one dry gallery and one-half of the floor drainage system of two adjoining filters has been flushed recently. In the drains, the practice has been to use small short-handled scrapers in the floor drains and pull sludge and growth to the main drain. Our experience is that sludge continues to move to the main drain for some time afterward. Ultimately water will be available in the three other dry galleries for flushing purposes. In winter ice has been found in the floor drains a considerable distance from the open easterly ends of the main drains and dry galleries; it is probable that bulkheads will be placed at all of these entrances.

Data so far presented cover operating conditions that indicate the necessity of changes which will greatly facilitate trickling filter operation. These conditions are presented so that the designer and construction engineer may benefit from operating experience.

While a number of methods of operation of the filters have been tried, all with apparent success, the rate of operation has made no special demand upon the selection of a method. During 1928, all filters were in almost continuous operation, without rest periods, and the results of operation have been the best since the plant was placed in service. With favorable conditions, the writer believes that continuous filter operation will give better results; a balance between the filter load and the biological medium of purification becomes firmly established.

Uniform distribution of influent and free drainage of effluent are two essentials of successful trickling filter operation, and the design carefully covers these features. The construction engineer should be able to appreciate that the cleanliness and uniformity of size of the filter material spell success or failure of filter operation and involve a large proportion of the cost of filter construction. Our experience has demonstrated that successful filter operation at minimum expense can be assured if design and construction receive careful attention.

The efficiency of trickling filter treatment of Imhoff tank effluent during 1928 is presented in the accompanying table, together with that of final settling tank treatment of filter effluent.

EFFICIENCY OF TRICKLING FILTERS TREATING IMHOFF TANK EFFLUENT

	Tank Effluent	Filter Effluent	Final Effluent
Average daily rate of operation, m.g. per acre	1.75	.....	.....
Settleable solids, c.c. per liter, 1 hr.[1]	0.77	2.82	2.11
2 hr.[1]	1.28	3.59	2.76
Suspended solids, parts per million[1]	114	120	77
Biochemical oxygen demand, p.p.m.[1]	98.8	20.4	18.8
Nitrogen as nitrates, p.p.m.[2]	.....	5.71	5.00
Nitrogen as nitrates, p.p.m.[3]	.....	4.37	4.32
Dissolved oxygen, p.p.m.[3]	.....	5.42	5.00
Relative stability, per cent[4]	.....	93+	92+

[1] Averages, daily composite hourly samples.
[2] Averages two or three times weekly, daily composite hourly samples (including Sunday).
[3] Averages catch samples, three times weekly, each filter and tank.
[4] Averages ten times monthly, daily composite hourly samples.

The settleable solids and suspended solids results indicate a precipitation in the filter of iron which passes through the filter. The possibility of greater nitrification by trickling filter treatment of domestic sewage as compared with industrial sewage is well shown by the nitrate results. The filter effluent was almost perfectly stable from Apirl 24 to Nov. 30, 1928, only eight samples failing to retain the blue color the required fourteen days.

CLAMP FOR END SPRINKLER NOZZLES AT WORCESTER

To facilitate removal of the nozzles at the ends of the distribution laterals for flushing purposes a special means of attaching the nozzles is used.

Cost of operation of the dosing tanks is included in that for the trickling filters. In 1927 filter operation cost averaged $1.42 and in 1928 $0.85 per million gallons of sewage filtered. The largest factor in the difference was the cost of removal of excess stone from one section of filter in 1927.

There are four 60x120-ft. final settling tanks with the direction of flow across the short dimension. The total depth is 15 ft., divided into 8 ft. of rectangular tank and hoppers which are 7 ft. deep. Eight hoppers, each 30 ft. square, are in the form of inverted pyramids; each hopper is provided with an 8-in. cast-iron sludge pipe. Each tank has a capacity of 0.4032 m.g. above the sludge hoppers, representing a detention period of 1.4 hours for the filter effluent at the designed rate of operation. The effluent from the tanks is carried in a concrete channel, 2,500 ft. long, to the Blackstone River.

The 5-in. sludge pump, operated by a 15-hp. motor (both installed in 1929), lifts the sludge from the hoppers and discharges it onto sludge-drying beds. Sludge can be lifted to the Imhoff tanks; this method of disposal has never been tried owing to the large volume of sewage sludge handled by the Imhoff tanks. During this past summer the sludge discharge line was tapped just outside the pump-house and sludge is now pumped to the drying beds through 700 ft. of 8- and 10-in. cast-iron pipe.

During the first three years of operation numerous difficulties connected with sludge pumping from the final

settling tanks prevented maintaining these tanks in as clean a condition as desired.

Sludge drawing, without removal of top water, was made during the past winter by weekly operation of the new pump. Final settling tank sludge is sticky and does not slide readily on the 1 on 2 slope bottoms of the hoppers. Drawings were made by pumping only from five to ten minutes from a hopper and repeating the work the following day. The tanks were cleaned in March with entire success, the required time for one tank being reduced from 8 to 10 days to from $1\frac{3}{4}$ to 2 days.

Routine tank operation includes removal of grease foam from the influent channels and brushing of the final effluent weirs once a week. During tank cleanings large quantities of sand and stone grit which come from filter stone have been removed from the influent channels and certain sludge hoppers. Pumping final settling tank sludge into the Imhoff tanks seems unwise in view of this condition.

The efficiency of the final settling tanks is presented in data similar to those given for trickling filters and which have been included in that table. The stability of the final effluent has paralleled that of the filter effluent.

The cost of final settling tank operation in 1927 averaged \$0.83 and in 1928 \$1.29 per million gallons of tank influent. The total plant operation cost in 1927 was \$5.84, and in 1928, \$6.56 per million gallons of sewage treated. These figures represented 23c. and 26c. per capita contributing.

Have the results of operation demonstrated the wisdom of constructing a new sewage-treatment plant? The average cost during the last five years of operation of the old plant was \$8.37 per million gallons of sewage treated, or 38c. per capita. The quality of the final effluent discharged from the present plant has resulted in average percentage relative stability of river water below the plant of 89.4, 87.9 and 99+ during the past three years. Perfect stability of the river water at this station has prevailed since the summer of 1927. The former percentage relative stability at this station averaged from 65 to 80 for the year and from 50 to 70 during the summer months.

During the coming year there are four expensive projects which will have to receive attention: (1) completion of parking of the plant; (2) workshop, garage and compressor buildings in keeping with laboratory, to replace wooden buildings; (3) removal of excess stone from three sections (10.5 acres) of trickling filters, and (4) winter disposal of wet sludge.

The design of the new sewage-works was first started by Frederic A. McClure, city engineer; Matthew Gault, superintendent of sewers, and the writer. Mr. Gault died very suddenly on June 26, 1920, and Mr. McClure's resignation had been filed, to be effective June 30, 1920. This design was dropped and one of their own adopted by David M. Earle, city engineer, and Ralph G. Lingley, superintendent of sewers. Upon the death of Mr. Earle in September, 1924, Mr. Lingley became city engineer and Andrew B. Holstrom became superintendent of sewers. The latter was succeeded on April 1, 1929, by John H. Brooks, Jr. The construction of the plant was by day labor forces of the city of Worcester at an approximate cost of \$3,800,000. The operation of the plant is under the direction of the writer.

Hydraulic Jump Design for a 100 Sec.-Ft. Conduit

Energy Absorber Designed Without Preliminary Model—Velocity Reduced From 35 to 3.5 Ft. Per Second

By J. W. Jourdan and Oren Reed
Designing Engineer and Assistant Designing Engineer, San Joaquin Light & Power Corporation, Fresno, Calif.

REDUCING the velocity of water at the end of a drop in a small diversion ditch from 35 to 3.5 ft. per second (f.p.s.), a small hydraulic jump structure has proved an economic means of preventing excessive erosion at the outlet of a canal of the San Joaquin Light & Power Corporation in central California. Use of the hydraulic jump is usually confined to large quantities of water where models and extensive experiments are warranted as a part of the design. Careful analysis, use of formulas and particular attention to relative dimensions, however, proved the device could be adapted advantageously to smaller flows.

Reduction in velocity is required at the lower end of the Browns Creek ditch, with a capacity of 100 sec.-ft. where it drops 64 ft. through 275 ft. of 24-in. pipe before flowing into the Crane Valley reservoir. (See *Engineering News-Record*, July 5, 1923, p. 20, for description of placing concrete lining in this ditch.) The pipe discharges with a maximum velocity of 32 to 35 f.p.s. into a natural channel of decomposed granite soil, and a timber stilling box was installed originally to prevent excessive erosion.

The original stilling box was a wooden structure designed to split the stream of water against a stone-

FIG. 1—HYDRAULIC JUMP STRUCTURE ON A SMALL CAPACITY CONDUIT IN CALIFORNIA
Left—New channel paving below weir. Center—Channel below outlet showing type of soil formation to be protected. Right—Operating with 35 sec.-ft.

filled crib, creating a "boil" within a chamber. It was necessary to build a roof over this chamber and weight it down with rock to prevent spray from entering behind the side retaining walls and causing dangerous erosion. From the discharge chamber the water flowed over a serious of baffles and left the structure at a velocity of about 7 f.p.s. Below this point the slope is sufficiently flat to prevent erosion. Replacement of this wooden structure was necessary in 1928 because of erosion and undercutting at the downstream toe, although the timbers were still in fairly good condition.

Several types of velocity-reducing structures were studied before selecting the hydraulic jump for this location. One type considered involved the use of a heavy concrete baffle pier faced with steel rails. The jet,

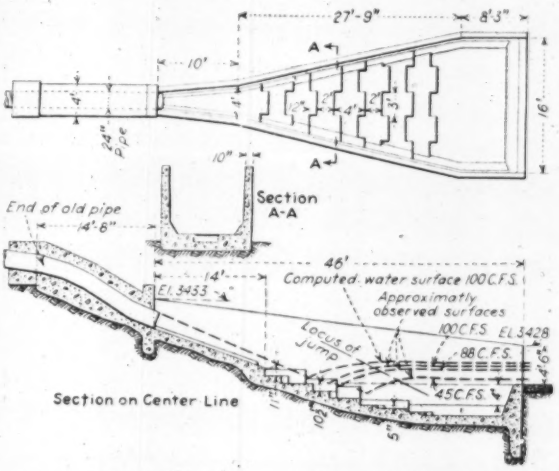


FIG. 2—DETAILS OF SMALL-SIZE HYDRAULIC JUMP

impinging against the concave surface of the pier, would be turned back upon itself, thus dissipating its energy. This structure would have cost about 30 per cent more than the hydraulic jump type due to the cost of the baffle and chamber roof and, in addition, the baffle pier would have required annual maintenance because of jet erosion.

The hydraulic jump structure was finally adopted because of: (1) lower first cost, (2) smaller maintenance charges and (3) assurance of proper operation at all stages of flow. The hydraulic jump pool was designed according to formulas and examples given in Report No. 3 and subsequent publications of the Miami Conservancy District. Theoretical water surface for the full discharge of 100-sec.-ft. is shown in Fig. 2.

Because of the depth of erosion at the old stilling box, it was necessary to lower the discharge outlet a distance of 6.5 ft. by welding a length of pipe to the old outlet. The new pipe is incased in a shell of reinforced concrete, which acts as an anchor and guards against vibration. The stilling pool has an over-all length of 46 ft. and an inside width increasing gradually from 2 ft. at the discharge pipe to 16 ft. at the end weir. Side walls have a maximum height of 9.5 ft. and are designed as cantilevers against either outside or inside pressure. Haunches were added to take care of outside pressure conditions that became apparent after construction had been started. Several earth slides resulted in an excess of excavation but added to the safety of the structure in reducing the possibility of subsequent slides.

During operation of the jump, water leaves the discharge pipe and flattens out on the sloping floor, which is roughened by offset steps. It was assumed in the design that the velocity of the sheet would not be increased on the inclined floor because of friction losses.

The hydraulic jump is formed when the sheet strikes the pool at the lower end of the structure. The pool is permanent and has a minimum depth of 4 ft. At maximum flow, water is discharged at a velocity of about 3.5 f.p.s. over the end weir at approximately the level of streambed.

In general, the hydraulic jump has functioned as expected, but with a somewhat higher velocity over the weir than was anticipated. This indicates that the velocity of the stream at a point just above the jump may be less than the computed velocity, resulting in a jump of less height. The stream is transformed into a mass of white foaming water, in which there is a complete and apparently uniform mixture of air and water with a very efficient dissipation of kinetic energy. The whole transformation takes place in a reasonably short distance, and during three months of operation the channel below the weir became settled and established. New rock paving, tied together with cable and old rail, has been placed to bring the channel level up to the elevation of the weir as shown in one of the accompanying views. Occasional maintenance work will be done to maintain the present level of the streambed to preserve the hydraulic functions necessary for proper action of the jump.

Conclusions—Use of the hydraulic jump for absorption of the destructive energy of pipe lines and conduits may be economical for cases involving relatively small quantities of water, discharging at medium or high velocities. Experience with the Browns Creek structure proves that fillets or haunches along the walls should not be carried into the upper part of the flow area, because at small flows they force the water to pile up in the center. The structure should be shaped so that water will spread evenly over the entire floor width before it reaches the pool. Haunches in the bottom of the pool, where they are always submerged, do not affect operation of the jump, and they help to support the walls. For best operating results, the walls should be built straight or with gradual flaring curves because the water does not adhere to side walls below a divergent angle, disturbing flow conditions. Observations at low flows, up to 25 sec.-ft., indicate that the middle of the first step should have been re-entrant in order to direct the stream toward the side walls. The present arrangement causes the water during low flows to leave the floor. At full flow the steps are entirely covered and the action is satisfactory. Spray conditions are not serious at any stage of flow.

Oslo's Subway Carries 3,200,000 Passengers in First Year

The only subway in Scandinavia, that in Oslo, Norway, carried 3,200,000 passengers, or an average of 9,000 per day, during its first year of operation, which ended Jan. 28. The Norwegian capital has a population of 250,000. Twenty-one cars are in operation on the subway.

Electrification of Railroads in Spain

Spain is planning to electrify 1,372 miles of railway line, including the widening of some narrow-gage track and the construction of two new hydro-electric plants.

Harahan Bridge Repaired After Fire Without Dismantling

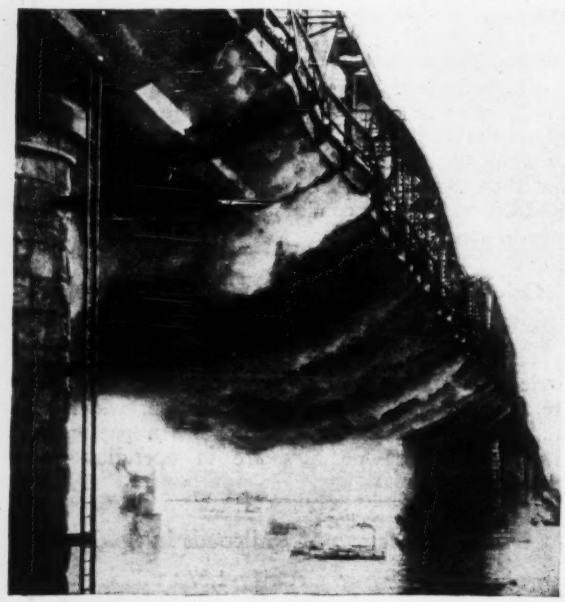
Main Trusses Not Seriously Damaged by Hot Fire in Timber Deck—Stresses in Chord Webs Found Reversed

By H. A. Wiersema
Morgan Engineering Company, Memphis, Tenn.

THE FIRE which damaged the Harahan bridge over the Mississippi River at Memphis, Tenn., last September and put it out of use for nearly two months was sufficiently unusual in its effects and in the repairs which it necessitated to be of widespread interest. The bridge is a combined railroad and highway structure with the timber roadway and railroad deck placed 10 ft. above the bottom chords of the through spans. The floor system consisted of steel stringers and floorbeams carrying the double-track railroad deck between the trusses and two 14-ft. highway decks outside the trusses on cantilever brackets.

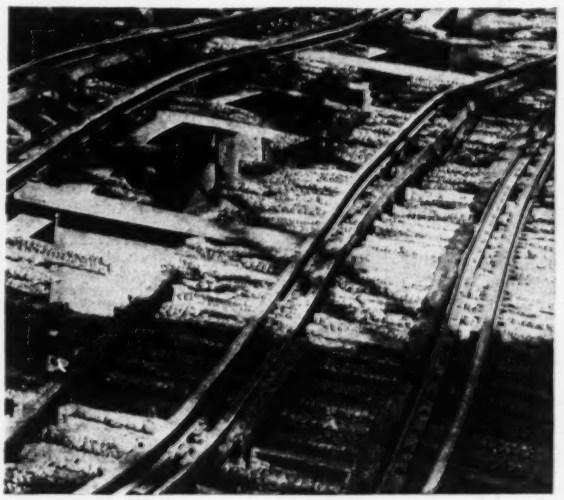
A full description of the fire, which occurred on Sept. 17, was published in the *Engineering News-Record* of Sept. 27, 1928, p. 489, and further investigation corroborated the opinion given therein that the main damage was to the floor system. It seems almost incredible that the entire floor system on this 790-ft. span could be so warped and twisted as to lose all resemblance to a floor system and yet the main truss members remain comparatively unharmed; but the only perceptible damage to these members was the buckling of one web of the upstream bottom chord in three different sections —one in each of the cantilever arms and one near the center of the suspended span.

That this damage was insufficient to endanger the truss was proved by the fact that the camber in this span, measured after the fire, when compared with the camber originally left on the completion of the structure, showed no perceptible difference. Also, in order to ascertain if the material, which was Mayari steel (with a nickel alloy), had lost any of its strength, specimens were cut out from the buckled web and tested. These showed an average of 94,000 lb. tensile strength—well above specification.



MAIN SPAN OF HARAHAN BRIDGE DURING FIRE
Note the warping of outer face of the deck.

It was decided therefore to replace the 27 panels of damaged floor system and allow traffic to cross on the downstream track, and later to repair the three sections of bottom chord by cutting out the buckled parts of the webs and splicing in new sections of silicon steel of approximately the same strength. The only difficulty in this process was the putting of the initial dead load stress into the spliced web, and this was accomplished by the method of "short pinning." The new piece of web was



CONDITION OF THE DECK FOLLOWING THE FIRE

drilled in the field so that the connection holes were $\frac{3}{16}$ in. eccentric with the holes in the existing web. One end of the splice was then made firm and the other end gradually was drifted into place with drift pins until the eccentricity was removed and the holes came true. It was considered that $\frac{1}{16}$ in. would be lost in this process but that the remainder of $\frac{1}{8}$ in. would be the actual deformation of this web, corresponding to a stress of about 9,000 lb. per sq.in., which was the designed dead-load stress.

When the buckled webs were burned through before removal, they were found to pull apart under a strong tension. This was quite unexpected on the cantilever arms, where the bottom chords are in compression, and it showed that the buckling of the web and consequent shortening was sufficient to reverse the normal compression into tension. A measure of the amount of this stress was had when the last portion of web broke under the stress. As the area of the fracture was 9 sq.in. and the ultimate strength about 94,000 lb., this web was under some 420 tons tension instead of the design dead load of 330 tons compression, or an average stress of 12,000 lb. per sq.in. tension instead of the design stress of 9,450 lb. per sq.in. compression. This tension, of course, was added to the load on the three other webs of the section of chord in varying amounts, probably more than doubling the compression in the adjacent web.

This chord section is made up of four webs, each web being a 39$\frac{5}{16}$-in. plate with two 8x8x1$\frac{1}{8}$-in. angles. Extensometer measurements were taken on the flanges and

web plates of the one new and the three old sections of web before and after the stress had been put into the new member, and the readings gave fairly consistent results. Assuming that the stresses in the webs were proportional to the readings taken and averaged, the following table shows the stresses that would have obtained at different times:

Web	Before Fire	After Web D Buckled	After Web D Cut	After Web D Replaced
A	C 9,450	C 11,240	C 10,230	C 9,600
B	C 9,450	C 17,510	C 12,970	C 10,300
C	C 9,450	C 21,050	C 14,550	C 10,800
D	C 9,450	T 12,000	0	C 7,000

While these figures are only approximate, they serve to illustrate the condition of the chord and prove that the repair was effective. The repair to the tension chord, while not so necessary, showed equally satisfactory results.

There is a question in the writer's mind as to whether any damage at all would have resulted if the fire had been allowed to run its course and the steel permitted to cool gradually instead of water being used to fight the fire. The testimony of the firemen is that the buckling occurred when the water struck the red hot steel.

The floor system was renewed and traffic resumed on the downstream track on Nov. 15, two days sooner than the estimated time. The chord repairs were completed by Dec. 15, but traffic was not put on both tracks then, because fire stops in the form of steel ties were being installed. These ties, a special design of the Rock Island Railroad, were substituted for wood ties every fourth panel. This was completed Feb. 15. The total of repair work and fire stops required 1,387 tons of steel.

The American Bridge Company designed the repair work and erected it on a cost-plus contract. Ralph Modjeski, the engineer on the original structure, inspected the span after the fire and approved the plan of repairs. The writer supervised the work for the railways.

A complete description of this bridge was published in *Engineering News*, Nov. 6, 1913, p. 930.

Garbage Disposal by Sanitary Fill Continues at Seattle

Plan Used Fifteen Years—Requests From Landholders Exceed Waste Supply—Nine Fills Permit 3-Mile Average Haul

THE sanitary fill as a means of garbage disposal has been used exclusively by Seattle, Wash., for about fifteen years, and present indications are that it will be continued indefinitely. After using the fill method during its early days, the city adopted dumping at sea as a means of garbage disposal from about 1890 to 1910, changed to incineration for several years and subsequently returned to the use of sanitary fill about 1915. The last change was brought about by increasing costs of incineration and the possibility of reclaiming large areas of low lands located in convenient points about the city. These developments have been outlined in *Engineering News-Record*, Nov. 23, 1922, p. 876; April 26, 1923, p. 761, and July 2, 1925, p. 11. In the following are summarized observations obtained from C. L. Murray, superintendent of garbage disposal, Seattle Department of Health and Sanitation, who has been dealing with garbage problems in that city for twenty years.

The amount of garbage handled at present averages about 2,000 cu.yd. per day, hauled by 50 trucks of 10-cu.yd. capacity, water-level measure. In handling dry waste the capacity of the trucks is doubled by a fencing of light lumber. Garbage is now being delivered to nine fills distributed about the city with a view to shortening truck haul. The average haul for each truck is now about 3 miles. The number of fills varies from time to time, as many as sixteen sometimes being used. The ideal is that number and distribution which will give a minimum average haul without an excessive cost for fill attendants.

Fills are located both on private and on public property, about 60 per cent of the garbage being dumped on the former and 40 per cent being used to reclaim low lands belonging to the city of Seattle and the State of Washington. City and state property are now used for two fills adjacent to Lake Washington, where city holdings consist of a 40-acre tract requiring a fill averaging 33 ft. deep to make the land available for a fresh-water park, and state property consists of more than 100 acres to be filled to a depth of 40 ft. for use as part of a golf course owned and operated by the state university.

During the first few years of extensive sanitary fill operations, ashes comprised the larger portion of waste collections during the cold months of the year. By skillful handling of this waste as it was placed on the fills it was possible to make the ashes serve as covering without the necessity of hauling dirt. In recent years the substitution of fuel oil for coal has eliminated this large ash tonnage and has necessitated the hauling of large quantities of fresh earth for covering material and smaller amounts of gravel for solidifying the roads across the fills. This change in the character of heating has reduced the tonnage of waste collected but has increased the yardage, since many of the larger buildings formerly burned the lighter waste materials in their coal furnaces which they now send to the dump in garbage cans.

The increase of bulky material tends to cause more settlement in the fills than the waste that contained a large percentage of ashes. During the period of heavy ash content one 65-ft. fill for street purposes settled about 1 ft. between the finishing of the fill and placing of the pavement five years later. At present fills in ravines varying in depth from 40 to 50 ft. may settle as much as 5 ft. after completion, provided they are made on solid ground.

Public co-operation with the department has been helpful in eradicating many unsightly places formerly covered with stagnant water, and applications are always on file from private property owners, requesting fills to be made on their property. Recently a survey was made to determine the probable value of the land produced by these fills and figures were placed at $250,000 for park property and $500,000 for public and private holdings.

Permit Issued for British Empire's Highest Building

A permit for the erection of what will be the British Empire's highest building superstructure, the new Bank of Commerce in Toronto, has been issued by the city architect's department. The superstructure, to be erected at King and Jordan Sts., at an estimated cost of $4,000,000, is to be constructed of stone, brick, steel and concrete, and is to be 30 stories high, or a total of 587 ft.

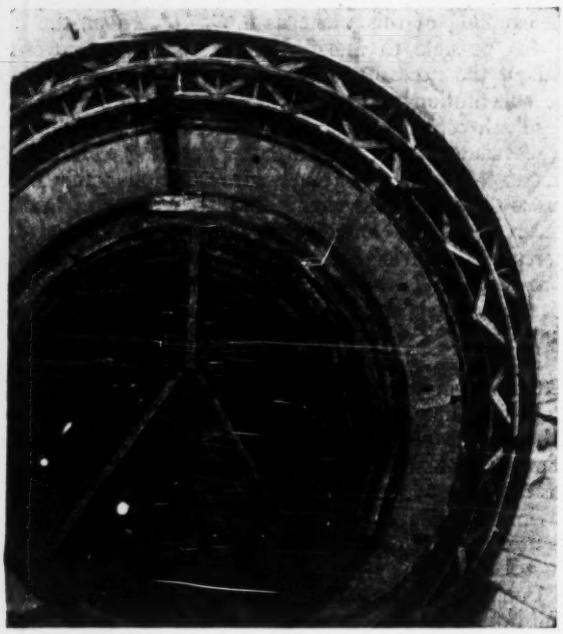
From Job and Office

Hints That Cut Cost and Time for the Contractor and Engineer

Circular Trusses Support Planks Closing Tunnel Plug Keyway

THE tunnel that is to serve as a means of river diversion during construction of the Owyhee dam in eastern Oregon will afterward be used to discharge floodwater from a vertical shaft 300 ft. deep connecting the tunnel with the circular spillway. Adapting the tunnel to this latter use requires that it be plugged just upstream from the shaft connection after the construction of the dam. Provision for a concrete plug was made by leaving a number of circumferential keyways 10 ft. wide and 18 in. deep in the tunnel lining.

The tunnel is lined throughout with concrete of 2½-ft. minimum thickness and is designed to permit passage of



CIRCULAR TRUSSES TO SUPPORT PLANKING TO CLOSE KEYWAY

the maximum flood flow of record. This made necessary the temporary closing of the keyways to maintain the hydraulic characteristics of the tunnel. To meet the two requirements, of not interfering with the tunnel lining process and at the same time providing for the temporary closure of the keyways, an unusual construction scheme was used.

In the accompanying illustration the finished tunnel lining in the foreground is shown interrupted by a keyway, and in the background the timber lining forms with inverted Y-supports are shown still in place. The supports between the back form of the keyway and the lining forms consist of built-up circular trusses (see illustration) with 2-in. blocking next to the lining forms. This construction eliminated the necessity of changing the typical lining form construction and also provided support for the 12 in. of concrete lining behind the keyway.

When the lining forms were moved forward the ring trusses remained, and after knocking off the blocking, they were used to support temporary planking. This planking closes the keyway flush with the lining, eliminating an abrupt change in cross-section of the conduit at this point. The short pipes protruding from the lining are 2-in. grout pipes.

Filtered Water Reservoir Used for Temporary Storage

By Arthur B. Morrill

Assistant Engineer, Department of Water Supply, Detroit, Mich.

A 20,000,000 GAL. reinforced-concrete filtered water reservoir now under construction in Detroit, Mich., for a time will be used for a purpose believed to be unique. The reservoir is on the site of the new Springwells station, which will not be ready for regular service for two or three years. The new station is about 11 miles from the present water-supply station in the southeastern part of the city. The large distribution mains between these two points, already heavily loaded, will have to meet still greater demands during the peak hours expected during the summers of the next few years.

This situation could be met only by expensive reinforcement of the distribution system or by storing considerable water at a point remote from the main pumping station. Work on the first section of the filtered-water reservoir was started in advance of that on any of the other structures, and this section will be ready for service in the spring of 1930. A temporary booster pumping station will be constructed at one corner of the reservoir, so arranged that much of the structure will eventually become part of a second filtered-water reservoir. The booster station will contain three pumps having a combined capacity of 45,000,000 gal. daily. Certain large mains, necessary for the final plan, will be laid during the coming summer to give an ample connection between the new reservoir and the distribution system.

On peak days, and possibly for a large part of the year, the operation of the reservoir will be as follows: It will be filled, usually between 10 p.m. and 6 a.m., from the distribution system through manually controlled valves. The rate of discharge into the reservoir will be increased gradually as the general demand of the city drops off, thus keeping the demand on the main pumping station more nearly uniform in the hours after midnight on maximum days. During the following day, and especially during the early evening hours when the sprinkling load is very great, the booster pumps will take water from the reservoir and discharge it back into the distribution system, thus improving pressures in the western part of the city by decreasing the volume of water that must flow through the mains during these hours.

The proposed plan involves a considerable loss of

energy, as the pressure in the mains will be lost when the water is discharged into the reservoir. Notwithstanding this fact, since the construction of the reservoir is necessary for another project, its temporary use in this way is much more economical than any other solution of the problem.

Minimum Sewer Grades

By Ernest McCullough
Consulting Engineer, Long Island City

THE writer was asked a few days ago by a young man who intends taking a civil service examination whether there is not a simple formula for determining minimum sewer grades, for he finds it difficult to memorize tables. We are experiencing a recrudescence of the "formula era," when everything was expressed in formulas and by rules. However, the most recent textbooks give only tables, and it is not hard to memorize a simple expression that has been developed from plotted data.

The late John M. Goodell translated Baumeister's "Cleaning and Sewerage of Cities" in the early 90's, the second American edition, published by Engineering News Publishing Company, appearing in 1895. On p. 2 appears this: "The following empirical formula will give the minimum grade for a sewer of a clear diameter equal to d inches, and either circular or oval in section: *Minimum grade in per cent* $= 100 \div 5d + 50$."

Experience soon showed that the expression was not correct and Patton in his "Civil Engineering" gave a table of minimum grades for sewers with diameters ranging from 6 in. to 48 in. In giving instruction a number of years ago to some young men on the construction of graphical charts and the development from them of empirical formulas, the grades given by Patton were plotted by the writer on cross-section paper, together with other grades given by various authorities. One of the students worked a long time over the chart and finally turned in the following:

"The minimum grade for sewers with diameters under 12 in. may be represented by a fraction having 1 as a numerator and with the denominator equal to ten times the diameter in inches. The denominator for the minimum grade for sewers with diameters from 12 in. to 48 in. $= 100 \div x$, in which $x = 100s = 60 \div (D^2 + 10d)$; D = diameter in feet; d = diameter in inches; s = sine of the slope."

He was somewhat crestfallen when shown that Patton evidently prepared his table by using a denominator produced by multiplying the diameter *in feet;* for all sewers having diameters of less than 12 in., by 120, and for all sewers having diameters 12 in. and over, by 200.

In "Sanitary Engineering," by Moore & Silcock (1898 and 1909), the following table of minimum grades was given,

8-in. pipe	$\frac{1}{175}$	15-in. pipe	$\frac{1}{600}$
9-in. pipe	$\frac{1}{250}$	18-in. pipe	$\frac{1}{800}$
12-in. pipe	$\frac{1}{400}$	21-in. pipe	$\frac{1}{1000}$

these grades being very much flatter than those given by Patton.

In the 1899 (third) edition of "The Separate System of Sewerage," by Staley and Pierson, the following minimum grades were given as having been used in practice,

6-in. pipe	1 in 142 = 0.704 per 100
9-in. pipe	1 in 203 = 0.494 per 100
12-in. pipe	1 in 385 = 0.260 per 100
24-in. pipe	1 in 775 = 0.129 per 100

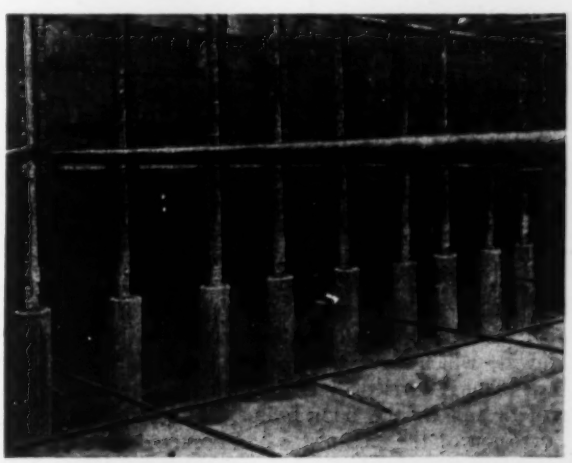
A large number of examples of sewers laid on low falls were plotted on cross-section paper and through the mass of dots a curve was drawn that kept the velocity at practically 2.25 ft. per second, with the sewers flowing half full and full. Selected points on this curve produced the following empirical expression, $x = 100s = 0.0215z - 0.0015z^2 + 0.000033z^3$ in which $z = 48$ — diameter in inches.

A new curve constructed with the above expression showed that the velocity varies from about 3 ft. per second in a 42-in. pipe to 2.25 ft. per second in a 6-in. pipe, flowing half full and full; therefore the civil service candidate may use it safely. If the sewers are to be laid in a district where a long time may elapse before they will be flowing half full nearly all of the time, it may be necessary to install flush tanks. An alternative would be to use the minimum grades given by Patton, it being understood that minimum grades are wanted only when the natural slope in the district is very low.

For sewers having diameters exceeding 42 in., it will pay to go to a little more trouble than is involved in using a rule intended for small pipes. In many places pipe sewers have been laid to even flatter grades than those above mentioned, but it is a practice not to be recommended when circumstances permit better grades. In computing the velocities mentioned above, $n = 0.013$ in Kutter's formula.

Porcelain Tubes Incase Reinforcing Bars for Sea Water Protection

PORCELAIN tubes were used to protect the reinforcing steel in the piers of the West Spokane St. bridge from possible sea water seepage at construction joints. The piers are subject to flexural stress that might allow the seepage of sea water along the horizontal construction joints. In order to protect the vertical steel bars at these points from the resulting deterioration,



PORCELAIN TUBES PROTECT STEEL AT UNDERWATER CONSTRUCTION JOINT

the design called for 3-in. tubes of porcelain, 30 in. long, to be slipped over the bars, according to C. H. Eldridge, junior bridge engineer, city of Seattle, so that half of the tube would be embedded in the concrete of the pier above and half below the joint. The space between the bars and the tubes was filled with a waterproofing compound. The accompanying illustration shows concreting completed to the construction joint with the tubes half embedded, ready for continuing the pour above the joint.

Diagram Gives Reactions at Pipe Bends

By Earl M. Buckingham
Hawaii National Park, Hawaii

THIS diagram has been found by the writer so save considerable time in the calculation of reactions at pipe bends. As it was developed primarily for use in connection with cast-iron water mains, the standard water-works bends are indicated by heavy lines, with lighter lines to show the angles of specially cast bends.

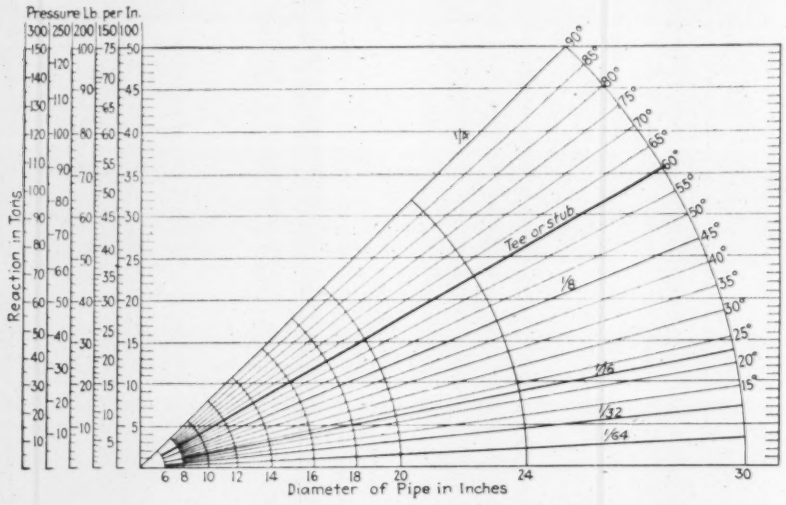
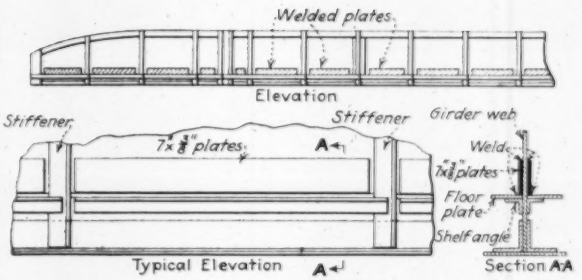


DIAGRAM FOR OBTAINING REACTION OF PIPE BENDS

To use the diagram, follow the arc of the pipe diameter to its intersection with the inclined line indicating the deflection angle, thence horizontally to the left, reading the reaction, in tons, in the proper pressure column. This gives a graphical solution of the formula $R = 2ap \sin \frac{1}{2}\Delta$, in which R is the reaction of the bend, a the cross-sectional area of the pipe, p the hydrostatic pressure and Δ the deflection angle.

Plate Girders Strengthened by Welding On New Material

WELDING additional plates to the webs of girders weakened by corrosion has been carried out by the Chicago & Northwestern Railway in reinforcing some of its older bridges in Chicago. On these through bridges, which have two girders to each track, a flat deck plate is carried by shelf angles on the webs of the girders and by the floor beams, but no ballast is laid. Corrosion of the web plates had occurred near the floor line, owing to accumulations of cinders, dirt and moisture. To strengthen the girders, $\frac{3}{8}$-in. plates 7 in. deep



NEW PLATES WELDED TO OLD GIRDERS

were applied to the web plates at the floor level, as shown in the accompanying drawing. Their lengths were 17½ in. to 6 ft., varying with the spacing of the stiffener plates or gussets riveted to the webs and floor-beams. After the floor was thoroughly cleaned along the girder a narrow strip was cut from the edge of the deck plate by a torch, so that the new reinforcing plates would be seated on the shelf angles. All paint on the contact surfaces was removed by burning and scraping. With the plates braced firmly against the girder web, their top edges were electrically welded to the web and their lower edges welded to the shelf angle, access to the web plate at this location being too difficult. A plate 5 ft. long could be welded at top, bottom and end in about one hour and fifteen minutes, this being welding time only. This work was done during traffic, under the protection of flagmen, but was interrupted for the passage of trains.

Two welders worked on two adjacent plates and had one helper. At first the plan was tried of welding two plates simultaneously on opposite sides of the web but this was found to result in trouble owing to the expansion and contraction during welding. The plan adopted, therefore, was to complete the work along one side of a girder, the two welders operating on different plates. Electric current at 42 volts and 275 amp. was generated by a portable plant set at the side of the track.

The contractor for the welding was the Anchor Welding Service, Inc., Chicago. This method of reinforcing the bridge was planned and carried out under the direction of O. F. Dalstrom, engineer of bridges, Chicago & Northwestern Railway.

Steel Delivered in Carloads by Barge to Building Site

BARGE transportation of railroad cars to deliver structural steel at site has been employed in constructing the new Clark St. bascule bridge over the Chicago River. Double-track transfer barges with six or eight cars each are towed from the railway yards to the bridge site, where the steel is unloaded from the cars by land and floating derricks. This method has been used also in delivering structural material for some of the large buildings that have been constructed on the riverfront.

Letters to the Editor

Possible Standardization of Cast-Iron Specials for Sewage-Works

Sir—Practically every specification for a sewage-treatment plant that comes to us shows a lot of odd, irregular or special castings. Could not some standard layout be adopted which would make for economy?

PAUL A. IVY,
Vice-President,
National Cast Iron Pipe Company.

Birmingham, Ala.,
July 13, 1929.

"Products or Dividends" Tables

Sir—The writer has a copy of a set of tables (title above) compiled by George Andrew Christensen (copyright, 1907, published by R. S. Kitchener, 954 Clay St., Oakland, Calif.) which is too worn for any further active service.

The writer has made several unsuccessful attempts to obtain another copy of this work; it is, of course, an old-fashioned device, but for some classes of engineering work it is just what one requires.

Doubtless there is on the market something better (larger type would be desirable, also size of book about that of Carnegie Pocket Companion), but where, and by whom?

C. B. GILBERT.
New York City,
July 23, 1929.

Disapproves of Niagara Treaty

Sir—Permit me to take exception to the editorial in *Engineering News-Record* of July 11, 1929, entitled "Unreasonable Tactics."

I hold no brief for the Illinois Senators nor for those Senators from the Northwest who are alleged to be responsible for the blocking of the so-called Niagara treaty, but I submit that it is entirely within the right and the duty of any Senator to have such a treaty referred to a committee for hearing and report and that it is unjust to ascribe to them selfish motives for such action. The manner in which the attempt was made to slip this treaty through the Senate without a hearing in the closing days of the last session is sufficient justification for the suspicions that are now directed against it.

The treaty is an attempt to amend the boundary waters treaty of May 13, 1910, which is the existing accord on the uses of international waters, and it does not require much stretch of the imagination to conceive that any amendment to this treaty must necessarily affect the Mississippi diversion, the St. Lawrence waterway, the Welland Canal, interlake channels and all other uses of international waters.

The existing treaty provides: Art. VIII . . . "The high contracting parties shall have, each on its own side of the boundary, *equal* and similar rights in the use of the waters hereinbefore defined as boundary waters." Art. V provides: "The United States may authorize and permit the diversion within the State of New York of the waters of said river above the falls of Niagara, for power purposes, not exceeding in the aggregate a daily diversion at the rate of 20,000 cu.ft. of water per second," and that: "The United Kingdom, by the Dominion of Canada, or the Province of Ontario, may authorize and permit the diversion within the Province of Ontario of the waters of said river above the falls of Niagara, for power purposes, not exceeding in the aggregate a daily diversion of 36,000 cu.ft. of water per second."

Whatever the reason may have been, at the time the boundary waters treaty was promulgated, for giving Canada 16,000 sec.-ft. more than the United States of the international waters at Niagara Falls, the division was certainly not an *equal* one and the proposed treaty does not balance the inequality by adding 10,000 sec.-ft. more to each side. The Supreme Court has enjoined the diversion of waters from Lake Michigan into the Mississippi watershed, and that diversion will ultimately cease or be greatly restricted, so it cannot be urged as a major consideration in the allocation of international waters at Niagara Falls.

With the engineering and financial resources available to to the two "high contracting parties" it is entirely possible to control the waters of Niagara Falls so that the maximum power potential may be developed, further erosion of the escarpment stopped and the scenic beauty immeasurably improved, and any one who contends that private capital has offered to spend $1,750,000 at Niagara for any other purpose than private gain must be simple or subsidized. The contention, besides being unreasonable, is childish.

ROBERT ISHAM RANDOLPH.
Chicago, Ill.,
July 15, 1929.

The force of what Mr. Randolph has to say is largely lost in view of the fact that the holdup of the treaty was directed or supported by Chicago Sanitary District and Illinois interests to provide a trading point with Canada. Just what is to be traded is not clear. The editorial in question did not, even by implication, make the contention which Mr. Randolph appropriately calls unreasonable and childish.—EDITOR.

More on Interstate Waters

Sir—I have been greatly interested in the recent correspondence in your columns relative to the tri-state water compact, which, in my judgment, is of vital importance to all the citizens of eastern Pennsylvania and western New Jersey. I agree with Mr. Breitzke that Art. IV is of itself indefinite, but even if co-ordinated with other clauses in the compact, its interpretation is not clear.

The compact has plainly two objects. One is the diversion of water into other watersheds than that of the Delaware River, and the other is the supervision and control of the Delaware channel and its tributaries.

Art. II defines "diversion." Except in case of true diversion, the commission apparently resigns jurisdiction over the tributaries of the Delaware River within a signatory state, but, as many technical questions might arise which are not covered by the wording of the compact, the way is opened for undue control by the commission.

There are many important problems for Pennsylvania and western New Jersey to face if this compact is ratified. Various commissions appointed to investigate and report upon the future water supply of Philadelphia have recommended that the supply be taken from the Tohickon, from the upper Lehigh or from the upper Delaware. Two of these sources of supply are entirely within Pennsylvania. Nevertheless, should Philadelphia attempt to act upon either of these recommendations, it must first obtain the approval of the tri-state commission, since the waters to be used would be returned into the channel of the lower Delaware, at a far greater distance than the 12-mile limit that is stated in the compact.

Should Philadelphia decide to go to the upper Delaware for its supply, it immediately comes into conflict with the city of New York and the metropolitan district of northeastern New Jersey, both of which are planning to divert 1,200,000,000 gal. daily to other watersheds. No matter what one's opinion of the meaning of the compact, the diversion of such an enormous quantity of potable water into other watersheds remains a violation of common law and a mortgage upon the future growth and development of the Delaware River.

Finally, this compact is fundamentally objectionable because it would establish permanent control by a superstate body, which could be dissolved only by the almost impossible "concurrent legislative action of all the signatory states."

WILLIAM EASBY, JR.,
Civil and Sanitary Engineer.
Philadelphia, Pa.,
July 30, 1929.

Interstate waters present obvious difficulty in taking a broadly non-partisan view of the problems involved. This difficulty may have something to do with the differences of view on the tri-state compact. Our correspondent, for example, speaks of diversion from the Delaware, but does not apply the term to the case of taking water from the Lehigh, though the latter procedure also reduces the flow of both the Lehigh and the Delaware below the point of diversion and affects water rights of other states.—EDITOR.

News of the Week

Mississippi Levee Contracts Authorized

Authorization has been received by Lieut. Col. F. B. Wilby, U. S. district engineer in Memphis, to award contracts for levee work in the Upper Yazoo and White River levee districts.

The Canal Construction Company, of Memphis, will receive the contract for 2,175,000 cu.yd. of levee enlargement and levee work between levee miles 3 and 10 in the Upper Yazoo district. This work will probably start Aug. 15, giving the contractor 830 calendar days to complete the work. The bid price was 23.83c. a cubic yard.

The contract for enlarging piece 15D in the White River levee district will be awarded to H. B. Blanks, of Tallulah, La. This contract involves the placing of approximately 1,170,000 cu. yd. of earth work at 26c. a cubic yard. Work will start about Aug. 15 and must be completed in 545 calendar days.

Railroad Extension Sought by Pittsburgh & West Virginia

Announcing that its object is to open up the industrial territory along the Monongahela River, now served only by the Pennsylvania Railroad, to the competition east and west of two trunk lines, the Pittsburgh & West Virginia Railroad has submitted to the Interstate Commerce Commission its project for the construction of a 5.77-mile extension connecting its line now under construction between Cochran's Mill and Connellsville, Pa., with the Donora Southern, owned by the American Steel & Wire Company. The line would extend from Pigeon Creek Crossing to Baird, Pa.

Cumberland Falls Project Before Federal Power Commission

Briefs submitted July 25 to the Federal Power Commission by proponents and opponents of the Cumberland Falls power project in Kentucky are being considered by the commission. Many of the people of the state are in favor of the project, and arguments in its favor have been advanced by representatives of ten Kentucky counties, who bring out that the granting of a permit will result in easier access to the falls, gorge and the 35-mile lake which will be created; a large increase in taxable property; the employment of from 2,000 to 3,000 men for two years at a time when activity in the region is at low ebb; and the industrial development of a dormant territory.

Opponents of the project base their main objection on the score of the preservation of scenic beauty, stating that the falls will be greatly reduced in volume, if not obliterated, by the building of a power plant. They also question the financial stability of the applicants and the jurisdiction of Congress over the upper reaches of navigable rivers. The jurisdiction of the Federal Power Commission has been voluntarily accepted by the power company. The Cumberland Falls project is being treated as a test case applicable particularly to the proposed development of the Great Falls of the Potomac.

Citv Manager Plan in Cleveland Under Fire

Cleveland, Ohio, on Aug. 20 will vote on a proposed amendment to the city charter which is, in effect, an abandonment of the city manager form of government. If carried, the amendment will abolish proportional representation, establish an elective mayor in place of the city manager, increase the size of the city council and provide for election of individual members of the council from separate wards. Cleveland has had the city manager of government for more than five years.

Miller Chairman of Oregon Railroad Commission

Frank J. Miller, appointed by Governor Patterson as a member of the Oregon Public Service Commission to fill the vacancy caused by the death of Louis E. Bean, has been elected chairman, the post occupied by Mr. Bean at the time of his death. Mr. Miller was the first secretary of the original Oregon Railroad Commission, serving from 1891 to 1893. In 1909 he was elected a member of the railroad commission, later was appointed to serve out the unexpired term of a commissioner who resigned because he was then Governor-elect, and then in January, 1910, took office on his election as commissioner, serving continuously until January, 1919.

Delegates Named to Congress on Housing and City Planning

Among the delegates appointed on the part of the U. S. Department of Commerce to the International Congress on Housing and City Planning to be held in Rome in September are Lawrence Veiller, of New York, secretary of the National Housing Association, and Robert Whitten, also of New York.

LAKE CHAMPLAIN HIGHWAY BRIDGE TO BE DEDICATED AUG. 26

The first bridge to be built across Lake Champlain, extending from Crown Point Reservation on the New York side to Chimney Point on the Vermont side, will open to travel on Aug. 26. Built by compact between the two states, the structure will be a toll project until paid for, after which it will be a free bridge. Although the lake is but 1,500 ft. wide at this point, the narrowest in its entire length of 140 miles, the bridge is 2,187 ft. long, consisting mainly of six truss spans, five of the deck type and one rising as an arch to give a 92-ft. underclearance. Fay, Spofford & Thorndyke, Boston, are consulting engineers on the project, with Merritt-Chapman & Scott as contractors on the substructure and the American Bridge Company, New York City, as contractor on the superstructure.

Court Upholds Golden Gate Bridge Project

In a decision rendered on July 31 the California Supreme Court upheld a former ruling of the Superior Court that the Golden Gate bridge and highway district formed for the purpose of constructing a bridge across the Golden Gate, the entrance to San Francisco Bay, had been legally organized and that the constitutional rights of those who had protested against the formation of the district and the inclusion of their property within its boundaries had not been violated. The Supreme Court's opinion was rendered on the petition for a writ of review of the lower court decision filed by a group of the protestants.

The case will be carried to the U. S. Supreme Court, according to Caspar Ornbaun, counsel for the opponents of the district.

San Francisco Plans to Build New Garbage Incinerator

Incineration of San Francisco garbage in a municipally owned and operated plant is the means of disposal which has finally been adopted by the Board of Supervisors of that city. Location of the new plant is to be in the vicinity of the present Thackeray destructor, which has been threatened for months by an injunction to close it down as a public nuisance. Bond election proceedings are to be started at once for an issue of approximately $1,000,000 to provide a new incinerator, and the city engineer has been instructed to make a personal study of plants in operation at Eastern cities to determine definite plans for construction.

This action by the board marks the first definite step to solve the San Francisco garbage disposal problem that has been taken for several years. Last year a committee made an extensive tour of cities in various parts of the country studying the question of garbage disposal to determine the best method to be used in San Francisco. The report of this committee, recently rendered to the board, indorsed the incineration method but accepted the fill-and-cover method as a temporary means to be used, if necessary, pending the completion of the new plant. Opposition against temporary fill-and-cover arose at once from property owners near the site, although the Board of Health reported that it would agree to the use of this method under strict supervision as a temporary measure during the actual construction of the new plant.

Meanwhile the injunction proceedings had been postponed from time to time, the court apparently hoping that some definite solution would be forthcoming before it became necessary to close the old incinerator and leave the city to dispose of 600 tons of garbage a day without any other facilities or even a definite plan adopted. On June 5, while the matter was still before the supervisors, the court issued an ultimatum to the board requiring definite settlement of the garbage question to be made within a 60-day period. Formal judgment was to be withheld during this time by the court, but it was plainly intimated that the judgment would be the granting of the injunction to close permanently the old incinerator as "obsolete, inadequate and a menace." The court further indorsed the incineration method and urged the city to acquire land for a new incinerator at the present site.

Five days after this ultimatum the board of supervisors approved three measures which practically settle the controversy. These are: (1) Incineration is to be adopted as the means of disposal; (2) the new incinerator is to be located in the general vicinity of the old one; and (3) the plant is to be municipally owned, built and operated. At the same time the board voted to postpone indefinitely the plan to use the fill-and-cover method for temporary disposal and it is hoped that the actions which have now been taken will result in holding up the pending injunction until the new plant is ready for operation.

Concrete Pavement Tests Being Made by Bureau of Public Roads

A concrete test pavement about half a mile long, made up of slabs 9 ft. square and 7 in. thick, is being constructed at the Arlington Experiment Station by the U. S. Bureau of Public Roads. When tests are made, engineers of the bureau hope they will show that the prevailing mixtures used in making concrete for roads may be modified by the use of a larger proportion of coarse aggregate such as gravel, slag or crushed stone, so as to effect a substantial saving in cost and at the same time increase the strength and durability of the pavement.

The prevailing mixture for concrete pavements is one part cement to two parts of sand and 3½ parts of crushed stone or gravel. It is thought that if it is possible to secure as good or better concrete when the proportion of broken stone or gravel is increased to 4½ parts, a saving of about $1,000 per mile in the cost of concrete roads will be effected.

The test road is being built just as an ordinary concrete road would be constructed except that the mixture for each slab will contain a different kind or amount of coarse aggregate and a different quantity of water. Mixing, placing and finishing of the concrete will be done in accordance with modern paving practice, using standard equipment.

After curing, the slabs will be drilled for cores and subdivided into beams suitable for flexure or bending tests. Supplementary tests will also be made on beams and cylinders cast at the time the pavement slab is placed, to show the relationship between the strength of molded specimens and that of specimens cut from pavement slabs.

Army Engineers Make Inspection Trip on James River

Army engineers from the office of Col. Henry C. Jewett, district engineer at Norfolk, Va., recently inspected the lower harbor of James River incidental to beginning work on straightening the three bends of the river by a series of canals at Turkey Island, Dutch Gap and Meadowville. The inspection trip was the result of a recent appropriation by Congress for river improvements from Richmond to Hampton Roads.

The War Department is spending $630,000 on the surveys and improvements to the James this year, an appropriation of $500,000 having been made for cutting a new channel, which work has been in progress for some time. An allotment of $100,000 and a surplus of $30,000 is being used in deepening the channel from the river mouth to City Point, where the city of Hopewell is situated.

Colonel Jewett now has three survey parties making preliminary estimates of the cost of deepening the channel to 25 ft. and shortening the distance to the sea by cutting canals through the major bends in the river. The surveys will be the basis of determining the final cost of the river improvement.

It is believed that the inspection trip will result in a revision of plans whereby the estimated cost of $7,000,000 for the work can be reduced approximately 40 per cent.

Iowa State Has New Method to Aid Graduates

A new method of assisting young engineering graduates to get a job is being tried by Iowa State College. As graduation time approaches, a leaflet is prepared in which all the information concerning each man in the class which would be asked for by any concern to which he applied for work is listed on a small sheet fitting a standard-size loose-leaf notebook. The information is printed on coated stock paper, so that the man's photograph can be reproduced as a halftone. The text matter includes details of his physical characteristics, the character of his preliminary schooling and college training, his school and college activities, his major interests and practical experience. These leaflets are sent to all individuals, industries or public utilities that may be interested in obtaining the services of one or more of the graduates.

The preparation of these biographical sketches is carried out by the personnel officers of the school, in order that the proper amount of information may be given and that it may be of a character to guide prospective employers in selecting men.

This year 50 sets of these leaflets were prepared and sent to leading industries early in January. They were provided with loose-leaf binders, to which the biographical data concerning other men may be added as they are sent out by the college.

New Bridge Planned Across Halifax Harbor

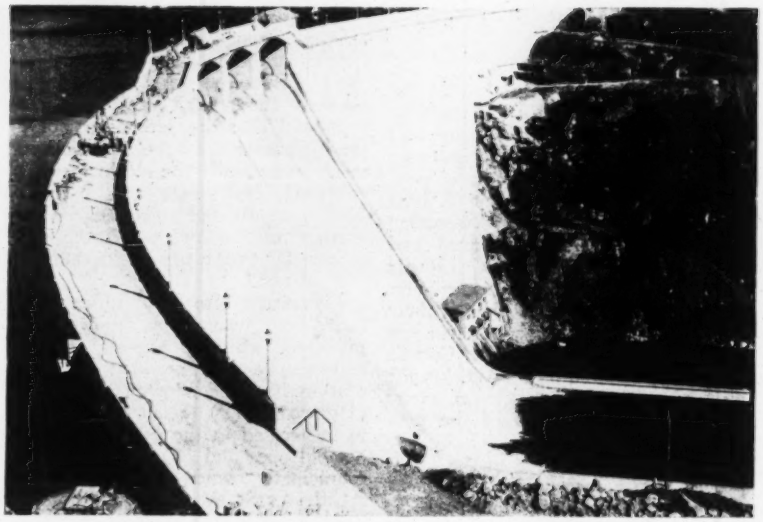
The Halifax Dartmouth Bridge Company has been incorporated to construct a projected bridge across Halifax harbor, the plans and specifications for which are under consideration by the dominion Department of Public Works. The proposal is that the viaduct be built at the Narrows, where the shores of the harbor proper converge to the channel that leads into Bedford basin. A 150-ft. clearance above high water is provided for in the plans, giving ample room for ships. The center span would be 960 ft. between the main piers. The bridge would shorten the main highway by about 20 miles, as it is now necessary to encircle the entire length of the basin to cross the harbor.

Americans to Present Papers at World Engineering Congress

Reservations have already been made by over 200 engineers from all parts of the United States who intend to be present at the World Engineering Congress to be held in Tokyo, Japan, in October and November, according to Maurice Holland, executive secretary of the American committee. Papers will be presented by many of these. Among the subjects to be covered which have already been announced are the following: "The Rapid Transit Subways of New York City," by Robert Ridgway; "Municipal Engineering in the United States," by C. E. Grunsky; "River and Harbor Engineering in the United States," by Major Gen. Edgar Jadwin; "Cement," by Thaddeus Merriman; "Public Health Engineering," by G. W. Fuller, H. P. Eddy and E. B. Phelps; "Ventilation of Vehicular Tunnels," by Ole Singstad; "Economic and Operating Considerations in Railroad Electrification in the United States," by Dugald C. Jackson; "Safety in Dam Construction," by Allen Hazen; and "Suspension Bridges," by Ralph Modjeski.

President Hoover has approved the appointment of seventeen delegates to represent the United States, as follows: Elwood Mead, director, U. S. Bureau of Reclamation; George Otis Smith, director, U. S. Geological Survey; George K. Burgess, director, U. S. Bureau of Standards; O. C. Merrill, formerly executive secretary, Federal Power Commission; Major Gen. Edgar Jadwin, formerly Chief of Engineers; Scott Turner, director of the U. S. Bureau of Mines; Elmer A. Sperry, past-president, Am.Soc.M.E.; Frank B. Jewett and John W. Lieb, past-presidents, A.I.E.E.; John R. Freeman, past-president, Am.Soc.C.E.; Maurice Holland; Daniel L. Turner and Byron Eldred, consulting engineers; J. V. W. Reynders and John Hays Hammond, past-presidents, A.I.M.E.; Mark Requa, mining engineer; and Dugald C. Jackson, past-president, A.I.E.E.

The American Railway Engineering Association has named as its official representative at the congress Louis Yager, assistant chief engineer of the Northern Pacific Railway, who is president of the association.



BULL RUN RESERVOIR FILLS PROMPTLY

Placing concrete on the Bull Run dam of the Portland, Ore., water supply was completed in January, 1929, and the first water flowed over the spillway May 14. The dam, fully described elsewhere in this issue, is of the gravity type, arched in plan, and is 200 ft. high storing 31,000 acre-ft. of water.

Subgrades and Pavement Bases to Be Studied by Roadbuilders

To begin at the beginning in future roadbuilding is the reason for a study of subgrades and pavement bases being made by the American Road Builders' Association through a special committee. In connection with this work, James S. Burch, Jr., committee engineer, is conferring with roadbuilding experts throughout the country.

Literally millions of dollars can be saved in road construction of the next decade by proper preparation of the natural earth foundation, it is pointed out by the association. Its committee on subgrades and pavement bases, to which Mr. Burch has been appointed engineer-investigator, is composed of prominent highway officials and roadway technicians.

"Economy in subgrade design has not received the amount of attention it deserves," Mr. Burch declares. "More roads wear out from the bottom than from the top. A proper subgrade is as important in its relation to the road as a foundation is to a building. In the last quarter-century, traffic requirements have grown so rapidly that roadbuilders have had to push construction in such a manner as to find little time to study the economic value of subgrade improvement. They have given considerable thought to the design of the pavement or surface, but in general have overlooked the foundation.

"A thorough study of road foundations is being made with a view to improving them so that the roads they carry will satisfy the requirements of modern and future traffic, increasing both the value and the life of roads. These improvements may be by proper drainage. The type of soils is a big factor in the drainage question and comprises a large part of the investigation. Other improvements may be made by addition of other kinds of earth or by treatment of the subgrade by chemicals and various mixtures."

Mr. Burch's investigation will carry him through the South and Middle West and to New England. The results of his survey will be embodied in a report to be made to the American Road Builders' Association convention at Atlantic City in January.

Advisory Body to Co-operate With International Exposition

The National Research Council announces the appointment of a special committee of scientists to serve as an advisory body of co-operation with the trustees of "The Century of Progress," Chicago's international exposition to be held in 1933. The executive committee of this advisory body, it is announced, will be the following:

Frank B. Jewett, New York, chairman; Gano Dunn, New York; M. I. Pupin, New York; William Allen Pusey, Chicago; George K. Burgess, Washington; Vernon Kellogg, Washington; Max Mason, New York.

In addition to this executive committee, a general committee on co-operation has been appointed, consisting of professional and technical men suggested by the presidents of national scientific societies in the various fields.

Details of the ultimate plan and form of the exposition have not yet been worked out, but it is stated that scientific progress in industry will be emphasized as the dominant note.

Brief News

THE MUNICIPAL INCINERATOR at Syracuse, N. Y., has been placed in operation. The ashes from the plant, which cost $200,000, are used to fill in waste lands near by.

A BOND ISSUE of $2,350,000 was recently authorized by the voters of San Diego, Calif., for the improvement of the municipal water system. Of this amount $2,100,000 will be used to increase the present delivery capacity, the major item being the construction of a second main pipe line estimated to cost $1,500,000.

PITTSFIELD, MASS., has passed an ordinance formally adopting the building code proposed by the American Welding Society to make available the advantages of welding in the construction of buildings in municipalities. This code was published in *Engineering News-Record*, July 18, 1929, p. 92. Pittsfield is said to be the first city to adopt it.

THE PRINCE OF WALES opened the London School of Hygiene and Tropical Medicine on July 18. The Rockefeller Foundation made a grant for the building, site and equipment. The school will be maintained by a Parliamentary grant and student fees and will be open to all nations for post-graduate and research work.

THE GENERAL CONTRACT for the construction of the main hangar for the Detroit city airport has been awarded to the W. E. Wood Company, Detroit, at a total price of $609,500. In general, the work consists of constructing a brick and steel one-story building approximately 200 ft. wide and 1,010 ft. long. It is believed that when completed this main building will be the largest hangar in the country.

A SEAPLANE AND LANDPLANE PORT is projected by the Toronto (Ont.) Harbor Commissioners, and a grant of $100,000 to cover the initial stages of construction of a seaplane harbor at Toronto Island has been approved by the City Council. The project calls for the expenditure of $569,000 over a number of years, this amount to be later stepped up to $2,000,000.

TO FULFILL the grade-separation program of South Bend, Ind., the Grand Trunk Western Railway has applied to the Interstate Commerce Commission for permission to relocate its line through the city. The project contemplates abandonment of about a mile of the present line and construction of a connection 1.29 miles long to the New York Central, over which the Grand Trunk Western has secured trackage rights.

THE NEW WATER-FILTRATION PLANT of the West Texas Utilities Company, at San Angelo, Tex., has been put into operation, assuring the city an ample supply of pure water. The plant, which increases the capacity of the old system by 50 per cent, is one of the most complete water-works systems in the Southwest. The capacity was increased from 3,000,000 to 4,500,000 gal. daily. Three pumps were installed, respectively of 6,000,000, 4,000,000 and 2,500,000 gal. daily.

AN IRRIGATION SYSTEM is projected by the State of Vera Cruz, Mexico, to serve lands in the vicinity of the towns of Carrizal, Rinconada and Cardel, lying in the valley of the Testados River, not far above the city of Vera Cruz. The project is unusual in contemplating a series of canals to join the Testados and the Jampa rivers, which follow a roughly parallel course to the Gulf. The project is described in *Ingeniería*, of Mexico, as having the advantage of unusually fertile soil.

United States Civil Service Examinations

The U. S. Civil Service Commission announces open competitive examinations for the positions of materials testing engineer, at $3,800 a year; for associate materials testing engineer, at $3,200 a year, and for assistant materials testing engineer, at $2,600 a year. The examinations are to fill vacancies in the Bureau of Standards, and applications must be on file with the commission at Washington, D. C., not later than Sept. 11.

An examination is also announced for the position of senior engineering aid in the bureau of construction and repairs, Navy Department. The entrance salary is $2,000 a year, and applications must be filed with the commission not later than Sept. 10.

WASHINGTON NOTES

By PAUL WOOTON
Washington Correspondent

New Recommendations on Flood Control Submitted — Plans for Boulder Dam in Preparation

SWEEPING changes in the present Mississippi flood-control plans are advocated in a report presented to President Hoover Aug. 8 by Walter Parker, of New Orleans, executive vice-president of the National Flood Prevention and River Regulation Commission. This document, compiled by A. B. McDaniel, of the Research Service, Washington, D. C., states that the control of the Mississippi problem by one bureau has been a dismal failure. Instead of improving, it is stated, the situation in its larger aspect gets progressively worse. To administer a consistent policy laid out on a sound practical basis by engineers and economists, the report urges the creation of a federal commission by act of Congress. Meanwhile it is recommended that existing branches of the government service, such as the Geological Survey, the Weather Bureau, the Mississippi River Commission and the Corps of Engineers, complete the fundamental data on which a comprehensive plan could properly be based.

The plan favored in the report contemplates a series of reservoirs on the Mississippi River tributaries to impound floodwaters. The levees would be raised to the grade provided by act of the last Congress and a short floodway would be constructed, probably at Bonnet Carré, to pass excess waters into Lake Pontchartrain. Various channel improvements would be made. The estimated cost is one billion dollars, requiring a construction period of ten to fifteen years. The belief is expressed that such an expense would be justified by the increased land values and by the power and possibly irrigation uses to which the impounded waters would be put.

Jadwin Retires

Major Gen. Edgar Jadwin, Chief of Engineers, U. S. Army, was retired Aug. 7 upon reaching the regular retirement age. Present indications are that his successor will not be named before the middle of the month. Meanwhile, General Deakyne is serving as acting chief. General Jadwin will shortly visit Japan as a delegate to the World Engineering Congress, and will also continue to serve as chairman of the board which is making a survey of the Nicaraguan canal.

Among candidates mentioned for the post of Chief of Engineers, consideration is being given the qualifications of Gen. Lytle Brown, an engineer officer who has been serving for several years as a general of the line.

General Brown has the reputation of being one of the best educated men in the army. He has completed all of the regular courses of study open to officers of the army, as well as other special educational work. He is recognized generally as a man of strong will and frequently has been in trouble with his superiors. During the Philippine campaign he was accused, unjustifiably, as was later proved, of graft in connection with the construction of a bridge. He served notice on the adjutant general that he would deal personally with his accuser. This he did in such thorough fashion that it is well remembered in the army to this day.

Despite the drastic and direct methods to which he has the reputation of resorting, General Brown is described as being kind and considerate. He is as popular with his subordinates as he is unpopular with some of those over him.

The points raised against him are that he has not been engaged actively in engineering work for many years and that his reputation is built entirely on his work on the military side of the army's activities. His last engineering was done just before the war, when he was district engineer at Chattanooga. At that time he was given the temporary rank of brigadier general and placed in charge of the officers' training camp at Fort McPherson, Ga. He did not go to France, but he did such outstanding work in training officers that he was

awarded a distinguished service medal. General Brown was chief engineer of General Pershing's punitive expedition into Mexico and has served in the engineering districts with headquarters at Louisville and at Savannah. He was born in Tennessee Nov. 2, 1872, and now is in command of Fort Davis, Canal Zone.

Boulder Dam Progress

Plans are being drawn by the U. S. Department of the Interior for a town, as yet unnamed, to be built on the Colorado River to house approximately 1,000 workmen and their families during the construction of the Boulder dam. This will take about eight years, and it is expected the community will continue in existence even after the work is completed, as the dam and the 100-mile lake created will undoubtedly attract many tourists. The site of the town is on government land, which will be leased to those who occupy it. It is expected that a "good-behavior" clause in the leases will aid greatly in maintaining order. As the community will be on the rim of the canyon, it will be necessary daily to lower and raise the workmen to the streambed. About 1,000 ft. of this vertical distance will be covered by means of elevators.

Work on the design of the dam, cofferdams, diversion tunnels and other features of the project is being carried on at the Denver, Colo., office of the Reclamation Bureau under the direction of R. F. Walter, chief engineer. An increase in the engineering staff is contemplated, for which appointments will be made from eligible lists maintained in Washington, D. C., as the result of civil service examinations.

Preliminary plans include four diversion tunnels, each 50 ft. in diameter and approximately one mile long. Two of these will be used as permanent spillways, and the other two as penstocks to supply the power house.

The only other work having to do with Boulder dam which is now under way is the survey that is being made to determine the location of the All-American canal across the river from Yuma, Ariz. A contract has been entered into with the Imperial Irrigation District and the Coachella Valley Water District providing for the expenditure of $100,000, which is to be supplied one-half by these irrigation districts and one-half by the federal government. The Reclamation Bureau already has a force of men in the field making this investigation.

No appropriations have yet been made of money for actual construction of Boulder dam. It is not expected that those appropriations will be made until the next regular session of Congress. That will be the long session of Congress, and since appropriations usually wait until Congresses are nearing their end, it is probable that no construction money will be available until some time next summer. There will be no opportunity for those who are clamoring for work on the great project until then.

Personal Notes

HERBERT B. BRIGGS, Ohio state architect since 1924, was removed from office July 10 as the result of disagreement over policies. RALPH RIDLEY, of Akron, was named to the vacancy.

WALTER HOVEY HILL, of Boise, Idaho, is making surveys and studies on the proposed 200,000-hp. hydro-electric development on the Salmon River, in Idaho County, Idaho.

Major JOHN F. CONKLIN on July 31 ended his term as U. S. district engineer at Nashville, having been transferred to West Point as an instructor in philosophy. He is succeeded at Nashville by Major FRANK S. BESSON.

T. K. HOLMES, former sales engineer specializing in oil field installations for the San Joaquin Light & Power Corporation, Fresno, Calif., has left that company to become sales manager for the Yosemite Portland Cement Company, with headquarters in San Francisco.

E. C. WILLIAMSON, hydraulic engineer, who has recently been employed by the Mississippi River Commission, at Memphis, is now located in the U. S. Engineer office, Mobile, Ala., in charge of the investigations and surveys being made on the Warrior, Black Warrior and Tombigbee river systems.

W. VICTOR OWEN, formerly chief engineering inspector for the town of Tonawanda, N. Y., in charge of the inspection and final acceptance of public construction work, is now in the building department of the chief engineer's office of the New York Telephone Company in Albany.

WILMER A. DEHUFF, principal of Polytechnic Institute, Baltimore, Md., has been appointed principal of the division of mechanic arts of Maryland Institute to succeed the late B. Wheeler Sweeney. The division of mechanic arts is a night school and Mr. Dehuff also will continue at his post at Polytechnic Institute.

Major J. J. LOVING, who has just finished a course in the General Staff School at Leavenworth, has been appointed resident member of the Board of Engineers for Rivers and Harbors in Washington. Major Loving is best known for his work while serving as assistant engineer commissioner for the District of Columbia.

FREDERICK A. REIMER, of East Orange, N. J., and C. P. FORTNEY, of Charleston, W. Va., have been appointed by President Hoover representatives of the United States on the Permanent Commission of the International Association of Road Congresses, which has its headquarters at Paris, France. Mr. Reimer is president of the American Road Builders Association and Mr. Fortney is president of the American Association of State Highway Officials. They will replace C. M. Babcock and Frank T. Sheets, who have resigned.

Engineering Societies

CALENDAR

ANNUAL MEETINGS

AMERICAN ASSOCIATION OF ENGINEERS, Chicago; annual meeting, Mexico City, Aug. 26-28.

AMERICAN WELDING SOCIETY, New York; fall meeting, Cleveland, Ohio, Sept. 9-13.

NEW ENGLAND WATER WORKS ASSOCIATION, Boston; annual convention, Portland, Me., Sept. 16-18.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York; fall meeting, Boston, Mass., Oct. 9-11.

* * *

THE UTAH SOCIETY OF ENGINEERS, at its recent annual election, chose the following officers: president, H. S. Kerr; vice-president, C. H. Jones; secretary, Ralf R. Woolley; treasurer, R. K. Brown.

THE CITY OFFICIALS DIVISION of the American Road Builders Association will hold a meeting in Washington on Oct. 24 and 25, before which city officials throughout the country are invited to lay their municipal airport problems. Leaders are being chosen for the discussion of subjects that arise in the selection of sites and in the construction of airports.

THE ASSOCIATION OF WESTERN STATES HIGHWAY OFFICIALS at a recent meeting in Boise, Idaho, re-elected the following officers for the ensuing year: president, Henry H. Blood, chairman of Utah Highway Commission; vice-president, Z. E. Sevison, of the Wyoming Highway Department; secretary and treasurer, J. D. Wood, Idaho Commissioner of Public Works. The executive board includes the three officers and L. I. Hewes, of the Bureau of Public Roads; W. C. Davidson, of New Mexico; and O. S. Warden, chairman of the Montana Highway Commission.

Obituary

ROBERT J. HARDING, former city engineer of Hudson and of Poughkeepsie, N. Y., died on July 31, in San Antonio, Tex., from injuries suffered in an automobile accident. Mr. Harding was 49 years old.

AXEL F. LINDGREN, president of Lindgren & Swinerton, Inc., contractors and builders of San Francisco, died in that city July 26. He was a past-president of the General Contractors' Association and also had served as a director and as treasurer of that organization. Among the San Francisco buildings which his firm had erected are the Telephone, Standard Oil, Southern Pacific and Hunter-Dulin buildings, the Public Library and the Civic Auditorium.

Construction Equipment and Materials

New Plan of Sales Promotion Adopted by Steel Association

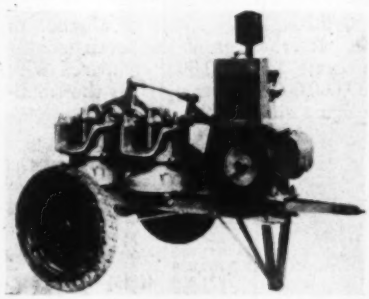
What is believed to be the first time a national trade organization has drafted into service officials of member firms has resulted from the formation by the American Institute of Steel Construction, Inc., of an advisory committee on salesmanship covering the New York district. This is made up of sales executives of the fabricators of structural steel in this district, and will meet monthly to advise on the work of the national body as regards the development of broader markets for structural steel. The organization meeting of the committee was held during July, at which time a number of subjects were discussed, including the development of a market for steel-frame residences, the utilization of steel in the erection of hangars, bridges and irrigation dams; technical problems dealing with the development of a steel-plate floor system; methods of fireproofing structural steel; and the use of steel in the erection of school buildings.

The next annual convention of the institute will be held at Biloxi, Miss., Nov. 13-16. The institute has also been invited to attend an international conference on steel construction to be held in Liége, Belgium, in August, 1930, under the auspices of the Belgian government. At approximately the same time the German Steel Syndicate (Stahlwerks-Verband) is planning a similar conference to be held at Düsseldorf, Germany, at which the American Institute has also been invited to participate.

New Developments

Double-Diaphragm Power Pump

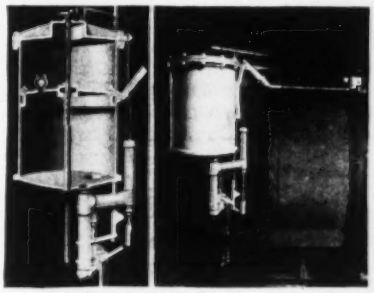
An engine-driven pump unit for use with any of the leading makes of double-diaphragm pumps, mounted on either a two-wheel cushion-tired trailer or four steel wheels, is being produced by the John Lauson Manufacturing Company, New Holstein, Wis. The unit is of compact lightweight construction, weighing approximately 775 lb. complete, and is powered with a 2½- to 3-hp. water-cooled engine with a speed range from 900 to 1,800 r.p.m., giving a maximum capacity of approximately 150 g.p.m. A feature of the motor is the counterbalanced crankshaft mounted in heavy-duty roller bearings lubricated from the engine crankcase. Ignition is by high-tension magneto; oil is circulated by a submerged plunger pump. The connecting rod used is interchangeable with Ford model T rods. A quick-acting sensitive governor of the fly ball type maintains constant speed.



PORTABLE PUMPING UNIT

Refinements in Paver Design

Accurate water control and easier operation are assured in the paving mixers manufactured by the Foote Company, Inc., Nunda, N. Y., by two new devices developed by its designing engineers. The first of these consists of a water tank of the vertical cylindrical type with a capacity of 46 gal., containing a piston in the head of which is an automatic valve which permits the air to escape when water enters beneath the piston. This piston is adjustable and can be set to measure any desired quantity of water in either gallons or pounds. The tank fills itself automatically and signals the operator when it is full, the control system being so arranged that the supply valve always closes before the discharge valve can be opened, and vice versa, eliminating any possibility of bypassing the water during the valve-shifting operation. Valves are operated by the pressure of the water in the tank, which never exceeds 5 lb.



AUTOMATIC WATER CONTROL FOR PAVING MIXER

Easier operation of the paver is secured by a new system of control known as the power operator. By means of two small levers the operating clutches of the paver can be thrown in or out almost instantaneously, the levers being so easily operated that they can be actuated with the little finger.

Side-Wheel Trencher Works at Close Quarters

Many advantages are claimed for a new side-wheel trenching machine recently added to the line of excavating equipment manufactured by the Harnischfeger Corporation, Milwaukee, Wis. On this machine the cutting wheel is mounted at the extreme left

TRENCHER CARRIES BUCKETS AT SIDE

which permits cutting close to a pole, curb or any other obstruction. This is also a valuable aid when cutting close to the edge of a highway. The cutting wheel projects 2 ft. beyond the outer edge of the crawler, making it possible for the traction mechanism to remain on the paved road. The machine will dig trenches from 20 to 28 in. wide and up to a depth of 5 ft. It is powered with a 55-hp. heavy-duty Waukesha engine.

Business Notes

PAGE STEEL & WIRE COMPANY announces that, effective Aug. 5, the sales department was moved from Bridgeport, Conn., to Pittsburgh, Pa. However, W. T. Kyle, general manager of sales, will be located at the general sales office in New York City.

BAY CITY SHOVELS, INC., Bay City, Mich., has completed a new fireproof factory building containing 18,000 sq.ft. of floor space for its assembly department. Work is now being started on another new building to house the offices of the company, including the engineering department, drafting rooms and auditorium.

NATIONAL LUMBER & CREOSOTING COMPANY, Texarkana, Ark.-Tex., has advanced Albert E. Ferguson, formerly in charge of its St. Louis sales office, to the position of general sales manager. Mr. Ferguson will maintain offices at both Texarkana and St. Louis.

FRUEHAUF TRAILER COMPANY, Detroit, Mich., at a meeting of the board of directors July 25 made the following executive appointments: August C. Fruehauf becomes chairman of the board; Harvey C. Fruehauf, president;

Harry R. Fruehauf, vice-president and director of purchases; Earl L. Vosler, vice-president and treasurer; G. W. Chamberlin, vice-president and director of sales; and Roy W. Jacobs, secretary and assistant treasurer.

AMERICAN ROLLING MILL COMPANY, Middletown, Ohio, has appointed W. J. Beck, for nineteen years director of research for the company, assistant to the general manager. He will be succeeded by Anson Hayes, formerly chief of the chemical division of the Armco Research Division.

New Publications

Concrete Treatment — AMERICAN FLURESIT COMPANY, Cincinnati, Ohio, has published a new catalog describing Fluresit hardener and waterproofer for concrete, with particular emphasis on the results of tests demonstrating the merits of this product.

Shovels—AMES SHOVEL & TOOL COMPANY, North Easton, Mass., has issued a new combined catalog 153 describing in 108 pp. all products of the company.

Spreaders—STOLLE ROAD EQUIPMENT COMPANY, INC., St. Louis, Mo., has prepared a leaflet describing Stolle spreaders for uniformly distributing road material from trucks.

Cement Admixtures — SILICA PRODUCTS COMPANY, Kansas City, Mo., in a 16-p. bulletin discusses the property of Aquagel, with particular reference to its use in cement and its products. Aquagel may be added to cement during the mixing process, or it may be ground into the cement at the mill. It is a silicate material similar in chemical composition to portland cement and has a number of uses outside of the cement industry.

Waterwheels—JAMES LEFFEL & COMPANY, Springfield, Ohio, is issuing a series of bulletins on typical Leffel waterwheel installations. The first of these features the open penstock installation with submerged type gate-operating mechanism. The second describes the Hamilton, Ohio, plant of the Ford Motor Company, at which waterwheels are installed in decked scroll penstocks with curved concrete elbow draft tubes. Other bulletins will follow.

Welding Rods—OXWELD ACETYLENE COMPANY, 30 East 42d St., New York City, has issued a 12-p. pamphlet describing Oxweld No. 1 high-test welding rod, developed for use in producing welds of uniform high strength. The first section of the book describes the development of the rod, tells where it should be used and gives the results of strength tests. The second division covers briefly the principles of joint design and the actual welding technique which should be employed to secure maximum results.

Construction, Labor and Material

E. N.-R. Index Numbers

Cost			Volume		
Aug. 1,	**1929**	**205.91**	**July,**	**1929**	**320**
July, 1,	1929	204.77	June,	1929	347
Aug. 1,	1928	207.29	July,	1928	266
Average,	1928	206.78	Average,	1928	287
Average,	1927	206.24	Average,	1927	263
1913		100.00	1913		100

Contracts to Aug. 1

Engineering construction contracts reported in the first seven months of 1929 amount to 25 per cent more in value than those of 1928.

(In Millions of Dollars)

	1929	1928
Buildings	$1,424	$1,174
Other private	327	103
Roads	320	375
Other public	475	378
Total	$2,546	$2,030

Real Estate Slightly Less Active Than in May

Real estate activity in June was 7 per cent slower than in May and 2 per cent under June, 1928, according to the index of the National Association of Real Estate Boards, whose statistics cover 63 cities. These statistics are deeds, and each month of 1926 is taken as the base for that month. Figures for the first six months of the last two years are:

1928	1929	1928	1929
89.6	87.2	82.6	85.6
92.7	86.8	90.2	88.7
85.2	82.3	84.2	82.3

The most active of the last six years was 1925, when the index exceeded 100 for eight months, with the minimum month 95.7. The preceding year, also, was more active than 1927-29.

How the Lumber Industry Controls a Weak Market

The policy of the lumber industry, "*production for sale* rather than *sell the production*," is well illustrated by the accompanying charts showing stocks and movements of West Coast lumber. Fig. 1 shows production almost constantly under the curves representing shipments and orders. Since Jan. 1 a preponderance of 5.1 per cent in orders

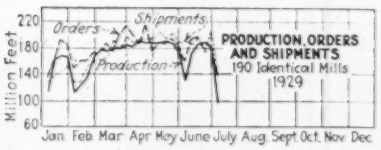


FIG. 1—TRENDS OF WEST COAST PRODUCTION, SHIPMENTS AND ORDERS

over production has been maintained by 190 identical mills. The speed between production and shipments is 4.2 per cent. Stocks at 102 mills decreased 9 per cent from Jan. 1, 1928, to Jan. 1, 1929, and 16 per cent to July 1 (see Fig. 2).

This year's production at 111 mills is 4.6 per cent under that of 1928, with orders 6.3 per cent below. This situation is ascribed to the decline in resi-

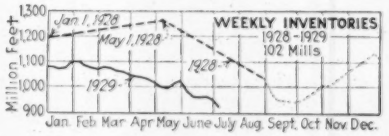


FIG. 2—STOCKS OF WEST COAST LUMBER

dential building and is expected to continue through the remainder of the year.

The West Coast Lumbermen's Association urges mills in both the California and Atlantic Coast trades to discontinue the shipment of unsold lumber to those markets. "While as a whole the situation is critical," says the association, "the record of the industry in holding down inventories, reducing production and maintaining firm prices during the first six months of the year furnishes the foundation for a fair year's business if these policies are continued." At 277 mills the average operation has been almost 30 per cent under capacity.

July a Dull Month for Public Bond Sales

July long-term public bond sales totaled $78,000,000, compared with $81,000,000 a year ago and $150,000,000 in June. The current figure does not include the large Chicago sale, listed in the accompanying tabulation, as these short-term notes mature in monthly installments from May 15 to Oct. 15, 1930. The largest sale was Philadelphia's $9,350,000 4½s due July 16, 1944, at 100.015. Quite a number of municipalities failed to dispose of their offerings, through rejections or absence of bids. Borrowings of the seven months aggregate $743,000,000, compared with $859,000,000 last year, and is the smallest figure since 1921.

	Amount	Interest	Yield
Asheville, N. C., general corporate and public improvement	$937,000	6	5.40@5.25
Birmingham, Ala.	280,000	5½	4.75@5.50
Brookhaven, N. Y. (Suffolk Co.), School Dist. No. 9	78,000	6	5
Charlotte, N. C.	2,130,000	5.80	5.50@5.25
Chicago, Ill., Board of Education	40,725,000	6	6
DeWitt, N. Y., Union Free School Dist. No. 5	260,000	5½	5
Linden, N. J.	641,000	6	5.50@5.00
Los Angeles, Calif.	3,700,000	4½	[illegible]@4.50
Pontiac, Mich.	821,000	4½@5½	4.60@5.25
San Antonio, Tex., Independent School Dist.	1,700,000	5	5.25@4.70
Tarrant Co., Tex., Water Control and Improvement, Dist. No. 1	2,000,000	5	5
Westchester Co., N. Y.	1,898,000	5.58	5.20

CONSTRUCTION NEWS

Some of the Week's Large Projects

AMONG the announcements for the current week are the following:

Proposed Work

Tunnels, New York, Bd. Transportation, New York, plans survey, $103,000,000. $2,000,000 voted for preliminary work.

Hospital, New York, N. Y., Lenox Hill Hospital, $5,000,000.

Gas line, California, Western Natural Gas Co., San Francisco, granted permit, $2,000,000.

Research, Ottawa, Ont., S. E. O'Brien, secy. Dpt. P. Wks., soon takes bids, $2,000,000.

Office, Winnipeg, Man., J. Richardson & Sons Ltd., $2,000,000.

Factory, Tulsa, Okla., Tulsa Cement Co., $1,800,000.

Bridge, Rochester, N. Y., $1,700,000 to $2,000,000.

Sewers, St. Louis, Mo., $1,165,000.

Memorial stadium, Jersey City, N. J., Bd. City Comrs., revised sketches, $1,000,000.

Nurses home, etc., Pittsburgh, Pa., Sisters of 3rd Order St. Francis, bids soon, $1,000,000.

College, Chicago, Ill., Sisters of Charity of Blessed Virgin Mary, Dubuque, Ia., sketches, $1,000,000.

Station, Windsor, Ont., Canadian Natl. Ry., Toronto, $1,000,000.

Bids Asked

Bridge, Chicago, Ill., Aug. 22, by City, substructure, total est., $3,500,000.

Apartment, Chicago, Ill., P. F. Olsen, archt., Chicago, taking bids for J. H. Cundy, c/o architect, $2,000,000.

Store, Milwaukee, Wis., Starrett & Van Vleck, archts., New York, bids about Sept. 1, general contract, for T. A. Chapman Co., Milwaukee, $1,500,000.

Power plant, Victoria, B. C., Aug. 31, by British Columbia Electric Ry. Co., $1,500,000.

Office, Pittsburgh, Pa., Sept. 1, by Gulf Refining Co., foundations, total est., $1,000,000.

Bids Received

Subway, Long Island City, N. Y., Bd. Transportation, New York, Sect. 5, Route 108, from G. W. Flynn, New York, $4,882,000.

Signal system, New York, N. Y., Bd. Transportation, from Charles Meads & Co., New York, $3,340,000 (18 months), $3,320,000 (20 months).

Sewers, St. Louis, Mo., Bd. P. Serv., from Anderson & Co., Chicago, Ill., $1,672,744. Est. $1,750,000.

Contracts Awarded

Power plant, Ashtabula, O., Cleveland Electric Illuminating Co., Cleveland, foundation to Hunkin-Conkey Constr. Co., Cleveland, total est., $11,000,000.

Bank, New York, N. Y., Farmers Loan & Trust Co., to G. A. Fuller Co., New York, est., $4,000,000.

Factory, Santa Ana, Calif., Pittsburgh Plate Glass Co., Pittsburgh, Pa., to Stone & Webster, Los Angeles, $4,000,000.

Apartment, New York, N. Y., Active Properties Co., to H. R. H. Constr. Co., New York, est., $2,500,000.

Club, Cleveland, O., Natl. Town & County Club, to Thompson-Starrett Co., New York, est., $2,300,000.

Bridge, New Jersey and Pennsylvania, Syndicate, c/o J. R. Cheeseman, Burlington, N. J., to McClintock-Marshall Co., Pittsburgh, Pa., est., $1,500,000.

House of detention, New York, N. Y., Dpt. Correction, general contract to Pstay & Fuhrman, Inc., New York, and others totaling $1,469,472.

High school, Chicago, Ill., Bd. Educ., general contract to W. E. O'Neil Constr. Co., Chicago, and others totalling, $1,136,227.

Schools, Hamilton, Ont., R. H. Foster, secy. Bd. Educ., to Piggott Constr. Co., Hamilton, $1,020,544.

Loft, New York, N. Y., Varick Holding Corp., to W. Ginsburgh, New York, est., $1,000,000.

Factory, Barrington, Ill., Holabird & Root, archts., Chicago, general contract to Lundorff-Bicknell Co., Chicago, for Jewell Tea Co., Chicago, $1,000,000.

Construction News of the Week

WATERWORKS

Proposed Work

Calif., Oakland—East Bay Municipal Utility Dist. plans 200,000 gal. steel water tank for Pinehaven Dist.

Ind., Carmel — City, R. Hinshaw, clerk, waterworks, $36,000. Municipal Engineering Co., 413½ Wabash Ave., Terre Haute, engrs.

Ind., Monon—City, waterworks improvements, $20,000; lighting plant, $50,000. Municipal Engineering Co., 413½ Wabash Ave., Terre Haute, engrs.

N. J., East Paterson—Bd. Boro Council, Boro Hall, mains in Old Boulevard, Coates and Elm Sts., Stone, Washington, Goldberg and Paulson Aves., $15,000. A. Noack, 106 Somerset St., Garfield, engr.

O., Kent—Bd. Control, bids in fall extending mains, also main trunk line in west side Cuyahoga River, $75,000.

Okla., Hydro—Waterworks, $25,000. C. A. Wood, Stillwater, engr.

Okla., Mangum—Preliminary plans additional well water supply, $25,000. H. T. Lawrence, Mangum, engr.

Okla., Snyder—Extending water mains, $15,000. W. H. Casland, mayor.

Pa., Pittsburgh—For c.i. pipe line and appurtenances for water service on South Side, $150,000. C. M. Reppert, City-County Bldg., engr.

Ont., Guelph—B. Marshall, archt., 612 Sheridan Rd., Chicago, Ill., soon takes bids electrically operated pumping station, 14,000 ft. mains, for A. C. Parsons.

Ont., Hamilton—For 6 in. and up c.i. mains in East 31st, King and Wellington Sts., $169,306. W. L. McFall, City Hall, engr.

Ont., Sandwich—See "Sewers."

Bids Asked

Calif., Alturas — Aug. 15, by E. E. Elliot, city clk., 10,000 ft. 4 in., 1,000 ft. 6 in., 3,100 ft. 8 in. c.i. pipe; excavate and back fill, 14,000 ft. trench; steel water storage tank, 36 in. dia. 40 ft. high; 1,000 g.p.m. well, turbine pump, etc. S. A. Mushen, city engr.

Calif., Chino—Sept. 3, by M. L. Birnie, city clk., well, installing pump, with 100 h.p. direct drive motor.

Calif., Ione—State bids about Aug. 15, water lines, electric power plant, concrete dam, to supply Preston School of Industry, $69,000. G. B. McDougall, Sacramento, state archt.

Calif., Oakland—Aug. 14, by J. H. Kimball, secy. East Bay Municipal Utility Dist., 685 gate valves 4- to 16-in. inclusive. Noted June 27.

Calif., Oakland—Aug. 17, by J. H. Kimball, secy. East Bay Municipal Utility Dist., aqueduct and transmission main, 24- to 44-in. dia.

Colo., Fowler—City, W. T. Barnard, clk., bids about Sept. 21, improving waterwork. $25,000. A. A. Weiland Engr. Co., 1st Natl. Bank Bldg., Pueblo, engrs.

Ill., Robbins—Aug. 13, by Village, 49,100 ft. 4- to 8-in. valves, 109 fire hydrants, 50 ft. 8 in. pipe, $147,908. Barker, Flavin, Sheets & Wallace, 35 East Wacker Dr., Chicago, engrs. Noted May 16.

La., Harrisonburg—Aug. 27, by Mayor and Bd. of Aldermen, waterworks.

La., St. Martinville—Aug. 26, by Town Council, 250,000 g.p.d. wood filter plant. L. J. Voorhies, Baton Rouge, engr.

THESE reports are grouped under each class (water-works, sewers, etc.) and under each stage of the work (proposed, bids asked, etc.) according to the alphabetical order of states.

Where name of official is not given inquiries should be addressed to City Clerk, County Clerk, or corresponding official.

Md., Brooklyn (sta. Baltimore)—Aug. 13, by Comrs. Anne Arundel Co., Court House, Annapolis, 12,500 lin.ft. 6- to 12-in. c.i. mains. J. A. Bromley, Court House, Annapolis, engr.

Mo., St. Louis—Aug. 20, by Bd. P. Service, City Hall, iron railing around all open basins at Howard's Bend Plant of St. Louis Waterworks on Missouri River. $20,000. L. Day, City Hall, comr.

N. Y., Long Island City—Aug. 15, by J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., New York, mains in Vernon and 44th Dr. Queens Boro.

N. Y., New York—Aug. 13, by J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., mains in Drake Park, S., Van Courtlandt Park, S., and Mosholu Parkway, S.; Drake, Magenta, McClellan, East 234th St., Arlington, Barnes, Bouck, Chatterton, Cruger Sts., etc.

N. Y., New York—Aug. 15, by J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., mains in Bronx and Pelham Parkways, Pelham Parkway, South, Continental Ave. and Eastern Blvd., Bronx Boro.

N. Y., St. George—Aug. 13, by J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., mains in Chelsea and Fox Sts., Lois Pl., Brentwood, Bryson, Butler, College Aves., etc.

O., Dayton—Aug. 14, by Comrs. Montgomery Co., 33,080 ft. 4- to 12-in. mains, 100 valves, 35 fire hydrants in Greenwich Village Water Dist., $50,000. P. E. Borchers, U. B. Bldg., co. engr.

Pa., Pittsburgh — Aug. 13, by E. G. Lang, dir. Dpt. P. Wks., 520 City-County Bldg., 36 in. c.i. pipe line and appurtenances across Monongahela River at South 13th St., $150,000. C. M. Reppert, City-County Bldg., engr.

S. D., Newell—Aug. 16, by City, 9,800 ft. 4- to 8-in. c.i. mains, Dakota Engr. Co., Mitchell, engrs.

Ont., Toronto—Aug. 13, by S. M. McCride, mayor, 2 mi. 6 in. mains in Glen Manor Dr., Kerr Rd. and 4 avenues, $15,000. R. C. Harris, City Hall, engr.

Contracts Awarded

Calif., Sacramento—H. S. Denton, city clk., 60 in. riveted steel by-pass line, for filtration plant, to H. Gould, 1022 27th St., $24,400. Noted July 25.

Calif., Sacramento—For 60 in. steel, by-pass line in filter beds at water filtration plant, to H. Gould, 1022 27th St., $24,400. Noted July 25.

Ia., Cedar Rapids—City, pumping station, filter plant structures, to Stark Constr. Co., Cedar Rapids; pumps to American Well Works, Aurora, Ill.; filter equipment, to International Filter Co., 333 West 25th Pl., Chicago, Ill.; clarifier equipment, to Dorr Co., 310 South Michigan Blvd., Chicago, Ill.; venturi meters, to Builders Iron Foundry, 122 South Michigan Blvd., Chicago, Ill.; valves and gates, to Rensselaer Valve Co., 53 West Jackson Blvd., Ludlow Valve Co., 249 South La Salle St. and Michigan Valve & Foundry Co., 30 North La Salle St., all Chicago, Ill. All bids rejected on steel tanks. Total est. $500,000. Noted July 4.

Kan., Anthony—City, reservoir, pipe lines, addition to pumping station and chlorine house, to W. B. Carter, Tulsa, Okla., $12,472; 6000 g.p.m. pump and motor, to Terry, Cowan & Smith, 1005 Davidson Bldg., Kansas City, Mo., $1,465.

Md., Baltimore—Bd. Awards, 3,615 lin.ft. 6- to 16-in. mains in North Point Rd., to Metropolitan Contg. Co., 220 South Highland Ave., $10,141; 760 ft. 48 in. mains and 19 tons 48 in. c.i. fittings in Druid Hill Park, to Ligon & Ligon, 3110 Ridgewood Ave., $12,700. Noted July 18.

See proposal advertising on page 125

Constr. News page 67

LEADITE

Trade Mark Registered U.S. Pat. Office

Melting *Leadite* prior to pouring joint.

"Yarning" joint with Braided Hemp.

Pouring the *Leadite* joint.

237.41 Miles of Water Mains in Flint, Mich. —Jointed with LEADITE

Another example of the widespread use and effectiveness of *Leadite* is the City of Flint, Michigan, of which Mr. E. L. Holloway is Superintendent, Board of Water Commissioners. This City has used *Leadite* for jointing 237.41 miles of cast iron water mains, ranging in sizes from 4" to 30" in diameter. The average working pressure is 75 pounds per square inch, but they have tested *Leadite* joints as high as 150 pounds pressure.

The tightness of their water system is indicated by their accounting for more than 90% of water delivered through Master Meter, which they feel is "very satisfactory."

The pioneer self-caulking material for c. i. pipe.
Tested and used for over 30 years.
"Saves at least 75%"

THE LEADITE COMPANY
Land Title Building Philadelphia, Pa.

No Caulking

Waterworks (Continued)

Mass., Boston—At Office Metropolitan Dist. Water Supply Comn., diversion dam and intake substructure at Shaft 8, of Wachusett-Coldbrook tunnell, to J. W. Bishop Co., 109 Foster St., Worcester, $213,077. Noted July 25.

Mo., Poplar Bluff—C. M. Hartwell, city clk., concrete filtration building, to G. H. Gassman, Poplar Bluff, $44,341; pumps, to Goulds Pump Co., c/o A. K. Howell Co., Syndicate Trust Bldg., St. Louis, $7,010; filter equipment, to E. W. Bachrach Co., Kansas City, $10,240; tank on tower, to Chicago Bridge & Iron Wks., Union Trust Bldg., Chicago, Ill., $19,600; pipe work, to H. H. Carrothers, 6803 East 39th St., Kansas City, $10,530. Grand total $91,721. Noted June 27.

N. Y., Brooklyn—J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., New York, mains in Avenue P, 3rd, 17th, 23rd and Myrtle Aves., to Empire Contg. Co., 21 Park Row, New York, $14,580. Noted July 11.

N. Y., New York—J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., mains in Zoological Park, Bronx Boro, to Sareno Contg. Co., $23,700. Noted July 18.

N. Y., St. George—J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., New York, mains in Henderson, Rathbun and Stafford Ave. to Empire Contg. Co., 21 Park Row, New York, $18,890. Noted July 11. 1

N. Y., Syracuse — Bd. Contract & Supply, City Hall, 3 gate houses for new reservoir to M. T. Berry, Syracuse, $36,975.

N. C., Concord—City, enlarging filtration plant, incl. tank, pumping equipment, etc., to McClellan Cont. Co., Charlotte, $48,305. Noted July 11.

Pa., Franklin—City clerk, 2.5 m.g. brick, hollow tile filter plant, to H. C. Tillman, Centralia, Ill., $133,834; pumping equipment, to Dravo Doyle Co., 302 Penn Ave., Pittsburgh, $1,613; 40,000 gal. elevated steel tank, to Chicago Bridge & Iron Co., Union Trust Bldg., Cleveland, O., $3,675; venturi meter to Builders Iron Foundry Co., Providence, R. I. $934. Grand total $140,056. Noted July 4.

Wash., Seattle—Bd. P. Wks., Proposition 2, Maple Leaf reservoir, pipe line, using lock bar steel pipe, to J. L. Smith Constr. Co., 2124 Madison St., $527,627. Noted May 16.

Wis., Milwaukee—Mains in North Ave., State, 7th, 8th, 9th and 10th Sts., to Wenzel & Henoch Co., 5025 State St., $38,353; Mitchell St. and Forest Home Ave., to Milwaukee Sewer & Drain Co., 928 Humboldt Ave., $8,232.

Wis., West Allis—Bd. P. Wks., 3,200 ft. 24 in. mains in Jersey St., to H. Hoheusie, 431 Ludington Ave., Wauwatosa, $28,277. Noted July 4.

Ont., Capreol—See "Sewers."

Ont., Wheatley—R. N. Epplett, village clk., pumping station, intake, c.i. mains, specials, to Merlo, Merlo & Ray, Sandwich St., East Windsor, $44,761; valves and hydrants, to Kerr Engine Co., Walkerville, $2,175; pumping equipment, to Turbine Equipment Co., 73 King St. W., Toronto, $5,700; elevated tank, to Horton Steel Wks., Bridgeburg, $7,415. Grand total $60,051.

SEWERS

Proposed Work

Calif., Alturas—City, sewage treatment plant, $50,000 or more. S. A. Mushen, city engr.

Calif., Carpinteria—Carpinteria Sanitary Dist., outfall sewer, disposal plant, $90,000 available. F. L. Johnston, 23 West Figueroa St., Santa Barbara, engr. Noted June 13.

Calif., Long Beach—Storm drain, pumping plant, north west section city, $50,000. A. H. Adams, city engr.

Calif., Los Angeles—For 48,307 ft., 51- to 24-in. rein.-con. and 21- to 12-in. cement pipe addition to sanitary sewerage system in Jefferson Storm Drain Sect. 5.

Minn., Howard Lake—Village, A. E. Strucks, recorder, sanitary sewerage system, $30,000.

Mo., Eldon—Rejected bids, sewage disposal plant, $25,000. J. W. Shikles & Co., 708 New York Life Bldg., Kansas City, engrs.

Mo., St. Louis—Bd. P. Service, City Hall, preliminary plans sewer in concrete lined tunnel with brick, segmental block, vitr. clay pipe connections, Southern-Arsenal Joint Sewer, $1,165,000. W. W. Horner, City Hall, engr.

Okla., Hydro — Sanitary sewerage system, $25,000. C. A. Wood, Stillwater, engr.

Utah, Kaysville—Sewerage system, $55,000. Caldwell & Richards, Salt Lake City, engrs. Noted June 13.

Ont., Listowel—Town Council, 8 in. and up vitr. tile sewers, disposal system, $30,000-$50,000.

Ont., Sandwich—East Sandwich Twp. 8 in. and up vitr. sewers, c.i. mains, valves, hydrants, etc., $175,000. Newman & Armstrong, Daves Blk., Windsor, engrs.

Ont., Sudbury—For ¼ mi. 8- to 30-in. vitr. tile sewers in O'Connor Park Sect., $140,000. S. A. Purves, City Hall, engr.

Ont., Swansea—Village soon takes bids, rein.-con. activated sludge sewage disposal plant with brick compressor building, equipment, motors, air compressors, valves, piping, 2 sewage pumping stations, $65,000. Wynne-Roberts, Son & McLean, Metropolitan Bldg., Toronto, engrs.

Bids Asked

Calif., Los Angeles — Aug. 26, by Supervs., Los Angeles Co., 6 and 8 in c.i. sewers, in McDonald Tract-Western Ave. To exceed $45,000.

Me., Portland—City, taking bids 555 ft. 8- to 10-in.; 634 ft. 8 to 12 in. sewer in Sewall St.

N. J., North Bergen—Aug. 22, by Twp. Com., Township Hall, repairing sewers in 32nd and 30th Sts. $25,000. R. Glenn, Township Hall, engr.

N. Y., New York—Aug. 12, by J. Miller, pres. Manhattan Boro, Municipal Bldg., sewers in West 34th and East 57th Sts.

O., Akron—Aug. 20, by F. E. Swineford, dir. P. Serv., 4,200 ft. 8- to 60-in. vitr. clay or brick, with lateral sewers in Forge St. Dist. A. B. Backherms, Municipal Bldg., engrs.

O., Dayton—Aug. 14, by Comrs. Montgomery Co., 10,300 ft. 36 in. precast or monolithic concrete, 165 ft. 30 in. concrete, 39,300 ft. 8- to 24-in. vitr. pipe, 175 manholes, 3 inverted siphons across Wolf Creek in Ft. McKinley Sanitary Sewer Dist. $150,000. P. E. Borghers, co. engr.

Pa., Phila.—Aug. 14, by Dpt. P. Wks., Bureau Eng. & Surveys, A. Murdoch, dir., Schedule B, branch sewers in 20th and West Upsal Sts.; Schedule C, sewage disposal interception at Milnor St., reconstructing branch sewer in Vandike St., intercepting sewer in Magee St.; grading, paving Private St. (formerly Wheatsheaf Lane).

S. D., Rapid City—Aug. 19, by C. I. Leedy, city aud., storm sewers in Dists. 6 and 7. $25,000.

Wis., Milwaukee—Aug. 12, by Dpt. P. Wks., sewers, various streets. Est. $100,000. R. E. Stoelting, comr.

Ont., Stratford—Aug. 9, by W. H. Riehl, engr., City Hall, compressor or blower equipment in connection with activated sludge sewage disposal plant. $40,000. Noted July 18.

Contracts Awarded

Calif., San Clement—City, 8 and 10 in. vitr. sewers, to Chutuk, Kordich & Vukojevich, 3518 Percy St., Los Angeles, $79,320.

Calif., Woodland—Sanitary sewerage system, 12- to 24-in. centrifugally spun rein.-con. pipe, to Prentiss Paving Co., 5th and Keyes Sts., San Jose, $106,840.

Colo., Alamosa—R. Davis, city clk., storm sewerage system, to Driscoll Constr. Co., 220 South Main St., Pueblo, $70,000.

Conn., Niantic—State, 3,700 ft. 6- to 12-in. sewer, sludge beds, filter beds, cement tanks, to N. Benvenuti & Sons, 74 Goshen St., New London, $42,500. Noted Jan. 17.

Kan., Ottawa—H. E. Rodgers, city clk., sewage disposal plant and outfall sewer, to W. B. Carter, 606 United Bank Bldg., Sioux City, Ia., $87,170 and $10,349 respectively. Noted July 4.

Md., Baltimore—Bd. Awards, manhole and handbox covers and frames for Bureau Mechanical-Electrical Service, to American Brake Shoe Foundry Co., Fulton Sta., $28,365. Noted July 18.

Mass., Fall River—United Merchants & Mfg. Co., Inc., c/o Weston & Sampson, engrs., 14 Beacon St., Boston, 1 story, brick, sewage disposal plant, plain found., to S. C. Sperry Co., 238 Main St., Cambridge. Est. $40,000-$50,000.

Miss., Houston—Mayor, complete sanitary sewerage system, incl. house connections, manholes, 48,460 ft. 6- to 15-in. sewers, 6 house branches, 160 manholes, flush tanks, concrete disposal plant, to Dobson & Humphreys, Omaha, Neb., $50,920. Noted June 27.

Mo., Kansas City — Bd. P. Wks., sewers in Dist. 608, Div. 7, to Kinlin Constr. Co., 3426 Michigan St., $27,566.

N. J., West Paterson—Mayor and Boro Council, School 1, sanitary sewerage system to J. Susino, 37 Danforth Ave., Paterson, $24,070; Sect. 2, to C. Alberto, Inc., Oxford St., Paterson, $41,190; and Sect. 3, to C. M. Bristowin, 354 18th Ave., Paterson, $14,178. Grand total $79,938. Noted June 20.

N. Y., Albion—Altering sewage disposal plant, to R. W. Rhodey, $45,552. Noted July 11.

N. Y., Brooklyn—J. J. Byrne, pres. Brooklyn Boro, Boro Hall, sewers in West 5th St., to Vacaro & Fornaro, 67.89% est. $28,608; 74th St. and De Witt Ave., to Manmill Constr. Co., 1780 Pitkin Ave., 89.3% est. $3,828 and 85% est. $2,000 respectively; Hawthorne St., to B. Picone & Son, 18th St., 80% est. $3,821; East 17th St., to Del Mel Constr. Co., Inc., 7624 15th Ave., 70.5% est. $2,204; 90th St., to F. B. Cassidy, 90% est. $1,260; Williams Ave., to Ferbon Constr. Co., 88.59% est. $250. Noted July 11.

O., Cleveland—City, 591 ft. 12 x 15 ft. concrete sewer in East 40th St. outlet at Lake Erie, to A. L. Connelly Co., 1900 Euclid Bldg., $84,502.

O., Pepper Pike (br. Cleveland) — Village, sewers in Shaker Blvd., to Marra Constr. Co., 12460 Cedar Rd., Cleveland, $62,437.

Wis., Milwaukee — Dpt. P. Wks., R. E. Stoelting, comr., to John Brogan & Sons, 344 Prospect Ave., sewers in Capitol Dr. $34,266; Row north of Ruby Ave. $34,565; to P. & L. Co., 1107 Humboldt Ave., Dousman St. $1,817, 9th St. $1,054, 31st St. $418; to Wenzel & Henoch Co., 5025 State St., East St. $9,168, 76th St. $709; to M. D. Dervos, 457 Mineral Ave., Forest Home Ave. $2,207, Menomonee Dr. $336, Walker St. $825; to H. Hohensee, 431 Ludington Ave., Row north of Dakota St. $441; Walnut St. $468. Grand total $86,274.

Wis., Milwaukee—Dpt. P. Wks., R. E. Stoelting, comr., to T. G. Holton, 345 27th Ave., sewers in Burrell St. $4,176, East Morgan Ave. $1,687; to Wisconsin Sewer Constr. Co., 146 30th Ave., 56th St. $1,029, 9th St. $3,061, Fond du Lac Ave. $10,021, Oklahoma Ave. $829; to Klumb & Johnston, St. Francis, 64th St. $1,906, Townsend St. $6,960, 28th St. $4,028. Grand total $27,433.

Ont., Capreol—A. Brundage, town clk., vitr. tile sewers and mains, to Billington Stockdale & Sandrelli, 36 Klock St., North Bay, $70,135; c.i. mains, to Natl. Iron Corp., foot Cherry St., Toronto, $20,381; valves and hydrants to Canadian Valve & Hydrant Co., Brantford, $4,681; foundation for standpipe, to Duncan Constr. Co., Sudbury, $2,135. Grand total $97,332.

WASTE DISPOSAL

Proposed Work

N. J., Westwood—Bd. Boro Council, Boro Hall, preliminary plans 30 ton municipal incinerator, $40,000. Herring & Westphal, 261 Bway., boro engrs. Noted Aug. 1.

Bids Asked

Tex., Childress—City, taking bids 1 story, brick and concrete incinerator, $25,000. Address L. Crawford, city secy.

BRIDGES

Proposed Work

Calif., Oceanside—State Hy. Comn., Sacramento, bridge over San Luis Rey River north of here, San Diego Co., $400,000. C. H. Purcell, hy. engr.

Calif., Stockton — Atchison, Topeka & Santa Fe Ry. Co., G. W. Harris, ch. engr., Kerckhoff Bldg., Los Angeles, steel bridge over San Juaquin River, $500,000 or more.

Florida—Citrus Co. (Inverness) and Sumpter Co. (Bushnell) plan Woods Landing Bridge, over Withlacoochie River, eight 40 ft. steel girder spans.

Ill., Joliet—City and Illinois Deep Waterway surveys bridge over Illinois River at McDonough St. $355,000. L. D. Cornish, Division of Waterways, Chicago, engr. Noted July 11.

N. Y., Rochester—H. Baker, Comr. P. Wks., City Hall, plans Ridge Rd. Bridge, $1,700,000-$2,000,000. F. P. McGibbeu, Black Gap, Pa., engr. Noted Feb. 14.

Pa., Pittsburgh—Comrs. Allegheny Co., Court House, Liberty Bridge Approaches, $143,000.

Tex., San Marcos—City, Hays Co., and State plan 140 ft. rein.-con., steel bridge over San Marcos River, 30 ft. $45,000. Address J. R. Wilhelm, mayor.

Ont., Toronto—City and Province of Ontario, replacing Humber Bridge on Lake Shore Rd., with 400 ft. concrete, steel span bridge, $550,000. R. C. Harris, City Hall, engr. Noted Jan. 24.

Bids Asked

Ark., Calion—Aug. 15, by State Hy. Dpt., State House, Little Rock, one 200 ft. through truss span; two 160 ft. and four 140 ft. deck girder spans, steel, rein.-con. bridge with 1,300 ft. rein.-con. deck girder approaches across Ouachita River. C. S. Christian, State House, Little Rock, engr.

Calif., Los Angeles—Aug. 26, by Supvrs. Los Angeles Co., two 50 ft. timber truss bridges over Walnut Creek, San Francisquito Ave.

Calif., Oroville—Butte Co., bids about Aug. 22, 300 ft. bridge on Bigrs-Princeton Road. J. A. Baumgartner, Oroville, co. engr. $25,000.

Calif., Sacramento — Aug. 19, by Supvrs. Sacramento Co., steel bascule bridge timber trestle approaches over American River on North B St., $200,000. J. A. Deterding, co. engr. Noted June 6.

Ill., Chicago—Aug. 22, by City, substructure double leaf trunnion bascule bridge over Chicago River at North Wabash Ave. Total $3,500,000. P. Schioler, City Hall, engr. Noted Apr. 18.

Maryland—Aug. 13, by State Roads Comn., Baltimore, extending two concrete bridges, Contr. Ho-67, Howard Co. H. Williar, Jr., Federal Reserve Bank Bldg., Baltimore, engr.

Michigan—Aug. 14, by R. W. Roberts, resident engr., Saginaw, M. Bridge 4 of 73-22-3, C-1 and 2, two 50 ft. spans steel deck girder, Saginaw Co., for State Hy. Dpt., Lansing.

New Jersey—Aug. 19, by State Hy. Comn., Trenton, 2 bridges over Grand Ave. and Northern R.R. of New Jersey, on Route 5 and 6, Palisades Park, Bergen Co. A. L. Grover, ch. clk.

N. Y., Elmsford — Aug. 26, by Westchester Co. Park Comn., 72 West Pondfield Rd., Bronx-

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Bridges (Continued)

ville, 2 stone faced, rein.-con., steel, river bridges on Saw Mill River Parkway, south of here. J. Bowner, Bronxville, ch. engr.; adv. E. N.-R. Aug. 8.

Ohio—Aug. 13, by R. N. Waid, dir. Hys., Columbus, concrete beam bridges in Athens, Hamilton, Darke, Jefferson, Muskingum, Portage, Vinton and Wyandotte Counties, $135,059.

Oklahoma—Aug. 20, by S. C. Boswell, state hy. engr., Oklahoma City, bridges on Project FA134-G, Carter Co.—Project S424, Rogers Co. —Project S505-D, Comanche Co.—Project S661, Cotton Co.—Project S604-DJ, Custer and Caddo Counties — superstructure for bridge Project S272-D, Atoka Co.—overhead bridge Project F162-G, Grady Co.

Pa., Phila.—Aug. 14, by Dpt. P. Wks., Bureau Engineering & Bridge Div., A. Murdock, dir. City Hall Annex, bridge over Reading R.R. tracks on Henry Ave. over Pennypack Creek, Welsh Ave.

W. Va., New Martinsville — Aug. 27, by Wetzel Co. Court, 4 bridges, 32 ft. span concrete arch over Little Fishing Creek at A. V. Shumans—30 ft. span over Long Drain at Carney School—20 ft. span arch or slab over Teagarden Fork of Long Drain—12 ft. slab or 15 ft., arch over Lower Run at Silver Hill. G. A. Harman, co. clk.

Ontario—See "Streets and Roads."

Ont., Toronto—Aug. 12, (extended date), by Toronto Harbour Comrs., Harbour Bldg., superstructure, steel bascule bridge over Ship Channel at foot Cherry St. $380,000. J. G. R. Wainwright, Toronto, engr. Noted July 25.

Contracts Awarded

California—State Hy. Comn., Sacramento, rein.-con. girder bridge over Graves Creek, San Louis Obispo Co., to W. Lane, Paso Robles, $10,977. Noted June 27.

Calif., Yreka—State Hy. Comn., Sacramento, bridge over Shasta River, 5 mi. north of here, Siskiyou Co., to M. B. McGowan, Call Bldg., San Francisco, $29,411. Noted July 4.

Florida — State Road Dpt., R. W. Bentley, chn., Tallahassee, Palm Beach Canal Bridge, Palm Beach Co., and bascule for Hillsboro River Bridge, Broward Co., to Nashville Bridge Co., Shelby Ave., Nashville, Tenn., $34,729 and $28,670 respectively—Alafia River bridge, Hillsboro Co., to F. B. Beasley, Tampa, $94,415 — Himmershee Canal and Tarpon River Bridges, Broward Co., to Joley & Millen, St. Augustine, $25,185 and $22,054 respectively—concrete for Hillsboro River Bridge, Broward Co., to W. S. Lockman, West Palm Beach, $52,302 — Pompano Canal and Middle River Bridges, Broward Co., to Murphy Constr. Co., Orlando, $46,097 and $34,570 respectively—Rice Creek Bridge, Putman Co., to Austin Bridge Co., Atlanta, Ga., $109,383 — Withlacoochie River Bridge, Marion and Citrus Counties, to Sahlman-Hagan Co., Fernandina, $24,409. Grand total $471,814. Noted June 27.

Fla., Miami Beach—Sunset Island Co., 2 concrete bridges between island and mainland, to M. F. Comer Bridge & Foundation Co., 1050 Biscayne Blvd., Miami, $42,500.

Mass., Boston—City, Dpt. P. Wks., steel concrete bridge over Midland Division of New York, New Haven & Hartford R.R. tracks, River St., to John McCourt Co., 910 Huntington Ave., $101,226. Noted July 25.

New Jersey — State Hy. Comn., Trenton, bridges in Monmouth Co. to S. S. Thompson Co., Red Bank, $37,553—bridges in Atlantic, Cape May and Cumberland Counties to Hill Constr. Co., Mt. Holly, $30,735. Noted July 18.

New Jersey and Pennsylvania—Syndicate, c/o R. Cheeseman, Juniper St., Burlington, N. J., bridge over Delaware River from Burlington, N. J. to Bristol, Pa. to McClintock-Marshall Co., Oliver Bldg., Pittsburgh, Pa. Est. $1,500,000.

N. J., Plainfield—Mayor and City Council, viaduct over Cedar Brook, to R and R Constr. Co., Easton, Pa., $148,743.

N. Y., Buffalo—Bd. Supervs. Erie Co., Court House, steel bridge at Amherst, to J. J. Miller & Sons, Tonawanda, $18,000. Noted July 4.

N. Y., Buffalo — Comrs. Erie Co., County Hall, bridge over Hunters Creek, Earl Hull Rd., to W. S. Meserve, Westbrook Apts., $11,389; and over Ellicott Creek, Maple Rd. to B. Behringer, Genesee St., $39,500.

Pennsylvania—State Hy. Comn., Harrisburg, concrete bridge and approaches, Luzerne Co., to Anthracite Bridge Co., 300 Genet St., Scranton, $73,884.

Pa., Harrisburg — For 173 ft. bridge over Pennsylvania R.R. tracks at Paxton St., to McGraw Constr. Co., Phila. Est. to exceed $100,000.

Pa., Oil City—Pennsylvania R.R. Co., T. J. Skillman, ch. engr., Broad Street Sta., Phila., substructure for 1,100 ft. steel bridge over Allegheny River, to Ferguson & Edmondson Co., Keystone Bldg., Pittsburg, $250,000. Total est. $1,500,000.

Vt., Fairfax—Town, Bd. Selectmen, steel truss bridge, Westford Rd. to T. J. Harvey, Adams. Est. $25,000 or more.

Ontario—Canadian Pacific Ry., Windsor Sta., Montreal, Que., J. M. R. Fairbairn, ch. engr., repairing 4 rein.-con., steel bridges, near Oshawa, to Nelson River Constr. Co., 124 Pears Ave., Toronto. Est. $50,000.

Ont., Kitchener—Council Waterloo Co., steel for 200 ft. bridge, at Wallenstein, to Hamilton Bridge Co., Bay St., Hamilton, $22,000; concrete for same, to L. J. Looby, Dublin $12,500. Noted June 20.

Ont., Toronto—For 500 ft. concrete, steel bridge on Spadina Rd. near St. Clair Ave., to Nelson River Constr. Co., 124 Pears Ave., $124,058. Noted Jan. 10.

STREETS AND ROADS

Bids Asked

California—Aug. 21, by State Hy. Comn. Sacramento, grading, untreated crushed stone or gravel surfacing 1.1 mi. San Joaquin Co.—untreated crushed gravel or stone surfacing 17.6 mi. Grazelle-Eureka Rd., Siskiyou Co.—produce and stockpile screenings 35.5 mi. Smith River-Oregon Line Rd., Del Norte Co.—widening with bituminous macadam border 3 mi. San Diego-Oceanside Rd., San Diego Co. C. H. Purcell, hy. engr.

Calif., Lynwood—Aug. 13, by W. Chapman, city clk., curbing walks, lighting system, compressed concrete paving 1,052,000 sq.ft., Century Blvd. To exceed $350,000. R. B. Miller, city engr.

Calif., South Gate—Sept. 3, by City Council, grading, curbing walks, 8 and 10 in. concrete on disintegrated rock or cementitious paving 693,734 sq.ft. Tweedy Blvd. To exceed $200,000. E. M. Lynch, Central Bldg., Los Angeles, engr.

Colo., Denver—Aug. 12, by Dpt. Impvt. & Parks, concrete paving 24 blocks Alley Paving Dists. 184 and 185. A. K. Vickery, City Hall, engr.

Conn., New Haven—Aug. 9, by City, bituminous macadam paving Bristol, Marvelwood, Plymouth, Rosette, Scranton and Stevens Sts. $25,000 or more. E. Nettelton, City Hall, engr.

Fla., Trenton—Aug. 14, by W. A. Gay, clk., bituminous surface treatment paving 20,000 sq.yd. H. S. Jaudon Eng. Co., Leesburg and Eustis, engrs.

Ill., Palatine—Village Clerk, taking bids improving streets. $150,000. Consoer, Quinlan & Older, 205 West Wacker St., Chicago, engrs.

Ind., Crown Point—Aug. 26, by Bd. Comrs., Lake Co., grading, draining, concrete paving H. E. Sasse No. 2 Rd., Calumet Twp. $82,200. W. E. Whitaker, co. aud.

Ia., Onawa—Aug. 12, at office aud. Monona Co., grading, draining 1.08 mi. on Blencoe-Preparation Rd. R. A. Rawlings, Onawa, co. engr.

Kansas—Aug. 14, by State Hy. Comn., Ottawa, chats surfacing 7.428 cu.yd. K-33, Project K-865, Franklin Co.—14,082 cu.yd. Project K-864, Franklin Co.—9,031 cu.yd. U. S. 75, Project K-868, Coffey Co. W. V. Buck, Topeka, engr.

Kansas — Aug. 16, by State Hy. Comn., Oberlin, (P. means Project), sand gravel surfacing 22.7 mi. P. 886, Rawlins Co.—16.3 mi. P. 878, Norton Co.—11 mi. P. 887, Decatur Co.—19.5 mi. P. 872, Decatur Co.—12 mi. P. 839, Thomas Co.—12.96 mi. P. 871, Sheridan Co.—15.417 mi. P. 874, Decatur Co.—16.3 mi. P. 878, Norton Co.—mortar fed surfacing 10.482 mi. P. 863, Osborne Co. W. V. Buck, Topeka, engr.

Kansas—Aug. 21, by State Hy. Comn., Cimarron, grading, culverts, 22—868 mi. Federal Aid Project 416, Gray Co., 30 ft. W. V. Buck, Topeka, engr.

Kentucky—Aug. 30, by State Hy. Comn., at office of J. S. Watkins, state hy. engr., Frankfort, grading, surfacing 9.5 mi., Calloway Co.—4.3 mi., Graves Co.—4.6 mi., Marshall Co.—4.8 mi., Trigg Co.

Maryland—Aug. 13, by State Roads Comn., Baltimore, concrete paving 1.8 mi. Contr. M-132, Montgomery Co.—1 mi. Contrs. Co-53 and D-52, Caroline and Dorchester Counties—macadam paving 1.2 mi. Contr. Q-52, Queen Anne Co.—concrete shoulders on 6.27 mi. Contr. H-75, Harford Co.—0.1 mi. on Contr. W-64, Washington Co. H. Williar, Jr., Federal Reserve Bank Bldg., Baltimore, engr.

Md., Baltimore—Aug. 13, by Bd. Awards, concrete paving 12,500 sq.yd. Contr. 532, N. L. Smith, Municipal Bldg., hys. engr.

Massachusetts — Aug. 13, by Dpt. P. Wks., State House, Boston, rein.-con. paving 1,634 ft. hy. Marlboro—gravel and bituminous macadam paving 6,165 ft. Westford—bituminous macadam paving 24,533 ft. Boxford, East Bridgewater, Milford and West Springfield. A. W. Dean, Dpt. P. Wks., engr.

Michigan—Aug. 13, by G. D. Tramp, resident engr., Crystal Falls, concrete paving 1.113 mi. MO42-8, C-1, 20 ft., Keweenaw Co., for State Hy. Dpt., Lansing.

Michigan—Aug. 21, by E. D. Crandall, resident engr., Cadillac, concrete paving 3.488 mi. MO24-17, C-3, 20 ft., Emmet Co., for State Hy. Dpt., Lansing.

Michigan—Aug. 22, by G. H. Green, resident engr., Alpena, concrete paving 0.997 mi. MO65-11, C-1, Ogemaw Co., for State Hy. Dpt., Lansing.

Michigan—Aug. 27, by A. R. Schaefer, resident engr., Newberry, concrete paving 3.281 mi. FO75-6, C-4, 20 ft., Schoolcraft Co., for State Hy. Dpt., Lansing.

Minn., Worthington—Aug. 14, by City, W. H. Buchan, clk., grading, curbing, guttering, concrete paving 9,000 sq.yds. $25,000. A. J. Anderson, city engr.

Miss., Laurel — Aug. 19, by Bd. Comrs., curbing, guttering, footwalks, sewers, concrete paving.

Mo., Marysville—Aug. 16, by G. H. Westfall, city clk., City Hall, grading, drainage 7 in. concrete paving 9th, 5th, Vine, Davis, 7th, 11th and 4th Sts. J. E. Resse, City engr.

Mo., St. Louis—Aug. 27, by Bd. P. Service, City Hall, asphalt paving 1,250 sq.yds. Utica St., $9,440—rein.-con. paving 1,100 sq.yds. Raien St., $5,320—2,160 sq.yds. Allemania St. $11,920—vibrolithic concrete paving 2,865 sq.yds. Hoffmann St., $16,000—warrenite bituithic paving 4,510 sq.yds. January St., $21,680—2,600 sq.yds. Kingshighway, Northwest $122,600 — 26,240 sq.yds. Bircher-Kingshighway, $156,240. W. W. Horner, city engr.

Nebraska—Aug. 15, by State Dpt. P. Wks., Lincoln, paving 24.9 mi. graveling 23.4 mi. grading 16.5 mi. roads and rein.-con. underpass. R. L. Cochran, State Dpt. P. Wks., engr.

N. J., New Brunswick — Aug. 15, by Bd. Freeholders, Middlesex Co. Court House, concrete 1½ mi., Prospect Plains-Half Acre-Hoffman's station Rd. W. F. Buchanan, Perth Amboy, co. engr.

N. Y., Buffalo—Aug. 15, by G. Fisk, comr. P. Wks., City Hall, paving and repaving Park Lane Ave., William St. extension, West Ferry, Cott, Best and Swan Sts. C. E. P. Babcock, city engr.

N. Y., New York — Aug. 12, by J. Miller, pres. Manhattan Boro. Municipal Bldg., sheet asphalt on concrete paving 5th Ave.

N. Y., St. George—Aug. 14, by J. A. Lynch, pres. Richmond Boro. Boro Hall, concrete curbing Virginia and Lincoln Aves., grading, bituminous macadam paving Pelton St.

Ohio—Aug. 13, by R. N. Waid, dir. Hys., Columbus, paving 45.366 mi. roads in Athens, Belmont, Darke, Defiance, Delaware, Gallia, Jefferson, Lorain, Medina, Mercer, Muskingum, Pickaway, Portage, Richland, Vinton, Williams, Wood and Wyandotte Counties, $1,520,506; tar surface treating 96.388 mi. roads in Allen, Clermont, Hamilton, Harden, Pike, Ross, Van Wert, Warren and Williams Counties, $105,410.

O., Akron—Aug. 12, by Comrs. Summit Co., 3 in. vitr. brick paving 2.38 mi. Cuyahoga Falls-Brittain Rd. $150,000. H. G. Sours, Court House, engr.

O., Akron—Aug. 26, by F. E. Swineford, dir. P. Serv., granite and concrete curbing, sidewalks, vitr. brick paving 4,800 sq.yd. Hardesty Blvd. $32,000. E. A. Remmler, Municipal Bldg., engr.

O., Columbus—Aug. 10, by Comrs. Franklin Co., F. L. Donnally, clk., bituminous macadam paving 2.37 mi. Rings Rd. 3, Washington Twp. $46,240.

O., Youngstown—Aug. 15, by Bd. Control, sheet asphalt resurfacing 5,000 ft. Elm and Wood Sts. $40,000. G. F. Turner, City Hall, engr.

Okla., Tulsa — Aug. 16, by City, c/o F. P. Kitchen, aud., curbing, grading, draining, 13th St., Paving Dists. 902 and 26th West Ave. Dist. 961, $53,026. P. C. Teis, Municipal Bldg., engr.

Pa., Ellwood City—See "Contracts Awarded."

Pa., Phila.—Aug. 13, by Bureau Hys., Dpt. P. Wks., City Hall, A. Murdoch, dir., Schedule A, asphalt paving Lenape, Parma and Sorrento Sts.; Schedule B, improving 61st (county) Rd.; Schedule C, asphalt repaving Emerald St.

Pa., Pittsburgh—Aug. 13, by City, curbing, grading, paving Bigelow Blvd., Wall, Maurice and Fairdale Sts. and 3 avenues. $260,400. C. M. Reppert, City County Bldg., engr.

Pa., Wilkinsburg—Aug. 12, by Boro. W. N. Baker, secy., Boro Bldg., curbing, draining, paving. $173,910. C. Sperling, Boro Bldg., engr.

S. D., Canton — Aug. 16, at City Auditors Office, curbing, concrete paving 5.73 mi. City and State joint hy. 18. J. Berg, Pierre, engr.

S. D., Rapid City—Aug. 19, by C. I. Leedy, city aud., curbing, grading, paving 52,212 sq.yds. $145,000.

Tex., Booker—Aug. 16, by City, c/o R. M. Lemon, city secy., grading, concrete paving 18,470 sq.yd. streets. Haste Engineering Co., Inc., 310 Burt Bldg., Dallas or Booker, engrs.

W. Va., Charleston — Aug. 20, by Kanawha Co. Court, gravel on stone surfacing 2,000 ft., Tuppers Creek and Amandaville Rds.; concrete paving 6 mi. C. M. Ross.

W. Va., Lewisburg—Aug. 17, by Greenbrier Co., Court House, grading, draining, paving with broken stone, 9 mi. road in Frankford Dist., 9 ft. J. K. Monroe, co. engr. Noted May 30.

Wisconsin—Aug. 14, by State Hy. Comn., W. C. Buetow, hy. engr., and Grant Co. Hy. Comr., Court House, Lancaster, grading, concrete surfacing 3.030 sq.yd. Lancaster-Beetown Rd., State Trunk Hys. 14 and 35, State Aid Project 918fA, and 1,700 sq.yd. Woodman-Mt. Hope Rd., State Trunk Hy. 132, State Aid Project 9233A.

Wisconsin—Aug. 15, by State Hy. and Eau Claire Co. Hy. Comrs., 213 South Barstow St., Eau Claire, grading, bridging 8.58 mi. Augusta-Fall Creek Rd., U. S. Hys. 10 and 12, Federal Aid Project 395-F.

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Streets and Roads (Continued)

Ontario—Aug. 13, by R. M. Smith, deputy minister P. Hys., Toronto, concrete paving 2 mi. north side Hamilton Hy., Contr. 29-98—4.4 mi. Thamesville-Dresden Rd., Contr. 29-100—concrete or mixed macadam paving 4.5 mi. Nelson-Freeman Rd., Contrs. 29-99 to 29-101—Mimico Bridge, Contr. 29-102—Belleville Bay Bridge, Contr. 29-103—Woodbridge Bridge, Contr. 29–104—Clandebaye division over Aux Sable River, Contr. 29-105—subway under Canadian Pacific Ry. at Woodbridge, Contr. 29-106—grading 6 mi. Brampton-Woodbridge, Contr. 29-107, $500,000. A. A. Smith, Dpt. P. Hys., Parliament Bldgs., Toronto, ch. engr.

Ont., Hamilton—See "Contracts Awarded."

Ont., Paris—Aug. 17, by C. B. Barker, town clk., concrete paving 1¼ mi. River St., 20 ft. $45,000. Margison & Babcock, Canadian Pacific Ry. Bldg., Toronto, engrs.

Contracts Awarded

California—State Hy. Comn., Sacramento, grading, asphaltic concrete paving, 10.3 mi., Chualar-Salinas Rd., to Peninsula Paving Co., Standard Oil Bldg., San Francisco, $236,484.

California—State Hy. Comn., Sacramento grading, concrete paving 8.7 mi., Alameda Co., to Hanrahan Constr. Co., Standard Oil Bldg., San Francisco, $325,306; asphaltic concrete paving 0.6 mi., Marin Co., to A. G. Raisch, 46 Kearney St., San Francisco, $10,147. Noted July 4.

Calif., Beverly Hills—Curbing, grading 69,898 sq.ft. Roberston Way and Whitworth Dr., to Knighton & Co., 625 Exton St., Inglewood, $56,060.

Calif., Los Angeles—Grading, curbing, concrete paving, Figueroa St., between 120th and 190th Sts., to G. H. Oswald, 366 East 58th St., Los Angeles, $170,434.

Calif., Los Angeles—Los Angeles Co., grading, compressed paving, 1,162,588 sq.ft., Co. Impvt. 862 Compton Ave., to G. H. Oswald, 366 East 58th St., $379,198.

Calif., Montebello—Grading, 8 in. concrete paving, 217,185 sq.ft. Greenwood St., to J. E. Haddock, 357 North Chester St., Pasadena, $58,285.

Calif., Oceanside — J. H. Landes, city clk., grading, concrete paving Vista Way, to Miracle Constr. Co., 4751 Monroe St., San Diego, $110,658. Noted April 4.

Calif., San Bernardino—San Bernardino Co., curbing, guttering, concrete paving, 1.5 mi. Beryl Ave. between Olive and Ananas St., to G. Gardner, 45 East Cypress Ave., Redlands, $42,705.

Calif., San Jose—Grading, curbing, asphaltic concrete paving, Polhemus St., to Prentiss Paving Co., San Jose, $27,168.

Calif., San Luis Obispo—San Luis Obispo Co. grading, warrenite on asphaltic concrete paving, Bay and King Aves., to Western Roads Co., 28th and Poplar Sts., Oakland, $117,201.

Calif., Santa Paula—Grading, 4 in. asphaltic concrete paving, 214,500 sq.ft. Ventura Ave., to Southwest Paving Co., Washington Bldg., Los Angeles, $61,295.

Calif., Whittier—Grading, curbing, walks, 6 in. concrete paving, 170,000 sq.ft., Pickering Ave., to G. H. Oswald, 366 East 58th St., Los Angeles, $37,650.

D. C., Wash.—District Comrs., District Bldg., 30,000 cu.yd. Northeast section to Loomis Constr. Co., 3532 M St., N.W., $0.445 per cu.yd.

Florida—State Road Dpt., R. W. Bentley, chn., Tallahassee, paving 5.05 mi., Wakulla Co., and Rd. 13, Alachua Co., to J. B. McLeod, 416 Tampa St., Tampa, $81,402 and $77,585 respectively—Rd. 27, Collier Co., to W. P. McDonald Constr. Co., Lakeland, $44,523—Rd. 2, Lake Co., to Manley Constr. Co., Leesburg, $81,556—Rd. 56, Columbia Co., to J. M. Gray, Gainesville, $27,344—Rd. 17, Hillsboro Co., to H. E. Wolfe Constr. Co., St. Augustine, $425,089—Rd. 10, Leon Co., to R. G. Lassiter Co., Jacksonville, and Southwest 27th Ave., Miami, $221,548. Grand total $959,047.

Ill., Evanston — Paving South Blvd., to M. Foley Co., Evanston, $45,239.

Ill., Palatine—Comrs. Cook Co., County Bldg., Chicago, paving 54,846 sq.yds. Plum-Grove Rd., to J. Mackler & Co., Chicago Heights, Chicago, $155,328.

Ill., Park Ridge—Comrs. Cook Co., County Bldg., Chicago, paving 25,589 sq.yds. Talcott Ave., to I. D. Lain, Waukegan, $63,213.

Ind., Anderson—Comrs. Madison Co., concrete paving West 13th, between Sherman and Sycamore Sts., to Daniels & McVough, Anderson, $32,447. Est. $35,000.

Ind., Connersville—Bd. P. Wks., improving streets, to O. J. Larkin, Greencastle, $40,000.

Ind., Crown Point—Comrs. Lake Co., macadam paving Fronck Rd., to J. W. Wheeler, Crown Point, $41,500; Kussmaul Rd., to J. Branock, Lowell, $32,690. Noted June 27.

Ind., Evansville—Bd. Comrs. Vanderburg Co., c/o T. W. McCutchan, guttering, bituminous macadam paving 17,720 sq.yd. Buchanan Rd., to T. O. Edmond, 213 South 4th St. Est. $65,999. Noted June 27.

Ind., Indianapolis—Bd. P. Wks., asphalt paving East Riverside Dr., to American Constr. Co., East Georgia St., $36,254.

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Ind., Kokomo—Bd. P. Wks., concrete paving West Markland Ave., to W. Watson Paving Co., Kokomo, $38,034.

Ind., Lafayette—Comrs. Tippecanoe Co., concrete paving Buskirk Rd., to D. M. Vaugham, Lafayette, $24,700. Noted June 27.

Ind., Laporte—Bd. P. Wks., concrete paving State St., to Cook Bros. Co., Laporte, $30,059.

Ind., Logansport—Bd. P. Wks., concrete paving Spear St., to D. A. Hyman & Sons, Logansport, $73,955.

Ind., Logansport—Bd. Comrs. Cass Co., concrete paving County Unit Rd. 7 to W. J. Nees & Co., Mishawaka, $51,763. Noted July 11.

Ind., New Albany—Comrs. Floyd Co., macadam paving 26,625 ft. Budd Rd., to Severin Bachman, Corydon, $60,169. Noted June 27.

Ind., Terre Haute—Comrs. Virgo Co., grading, brick paving Louis Seitz Rd., to J. A. Shepherd, Terra Haute, $41,039. Noted June 27.

Ia., Creston—Curbing, guttering, 6 and 7 in. gravel concrete paving 10,620 sq.yd., to J. S. McLaughlin & Sons, 519 Insurance Exch. Bldg., Des Moines, $93,589; 2½ in. brick paving 5,187 sq.yd., to G. G. Herrick, 540 46th St., Des Moines, $20,293.

Ia., Pumghar—I. L. Isenberg, and O'Brien Co., graveling 28 mi., to H. Kamminga, Boyden, $28,258.

Kansas — State Hy. Dept., Mankato, sand graveling 4.011 mi. roads in Dickinson Co., to W. D. Shay, McPherson, $10,205—3.768 mi. McPherson Co., to San Ore Constr. Co., McPherson, $9,494—grading, culverts 5.334 mi. Dickinson Co., to Yancey Constr. Co., Abilene, $60,579—0.519 mi. Morris Co., to Wyland & Yard, Tescott, $50,160—8.538 mi. Jewell Co., to Rogers Constr. Co., Norton, $59,820—5.957 mi. Jewell Co., to Western Bridge & Constr. Co., 3867 Leavenworth St., Omaha, Neb., $47,293. Grand total $237,551.

Kansas—State Hy. Comn., Topeka, concrete surfacing 4.337 mi. Federal Aid Project 355-C, Pottawatomie Co., to H. C. Botsford, Kansas City, Mo., $98,238.

Kan., Ottawa—Franklin Co., grading 8 mi., to A. L. Cook, Ottawa, $41,858.

La., New Orleans—Comrs. Council, to Southern Uvalde Rock Asphalt Contg. Co., New Orleans Bank Bldg., concrete foundations, Uvalde rock asphalt paving 4,891 ft. Daniel St., $112,314; 2,495 ft. Daniel St., $39,166; concrete foundations, warrenite bitulithic paving 12,573 ft. Bienville Ave., $393,015; curbing, concrete paving 1,948 ft. Forshey St., $34,141; to Craven & Long, New Orleans Bank Bldg., concrete foundation, oil asphalt paving 11,397 ft. Canal St., $321,035—to H. P. and J. F. Eagan, New Orleans, sub-surface drains, catchbasins 12,573 ft. Bienville Ave., $52,937 — to Louisiana Constr. Co., Inc., concrete footwalks, driveways, 12,573 ft. Bienville Ave., $33,320. Grand total $985,928. Noted Mar. 28.

La., New Orleans—Concrete footwalks, driveways 11,396.74 ft., Canal St. from Public Belt Tracks to Claiborne Ave., to H. W. Bond & Bros., 1025 Copernicus St., $157,595; subsurface drains, manholes, catch basins etc. 4,891.6 ft., Daneel St., from Peniston to Octavia Sts. to M. Mitchell & Sons, 323 Saratoga St., $55,984. Noted Mar. 28.

Maryland — State Roads Comn., Baltimore, concrete paving 0.2 mi. Contr. H-73, Harford Co. and 2 mi. Contr. B-96, Baltimore Co., to Harry T. Campbell & Sons, Towson, $8,124 and $47,472 respectively—1 mi. Contr. Q-47, Queen Annes Co., to P. D. Phillips & Bro., Salisbury, $19,826. Grand total $75,422. Rejected bids July 14 concrete paving 1.16 mi. Contr. S-35, Somerset Co. Noted July 18.

Maryland—State Roads Comn., Baltimore, sheet asphalt paving 0.68 mi. Contr. BC-78, Baltimore Co., to P. Flanigan & Sons, Harford Rd. and Baltimore & Ohio R.R., Baltimore, $62,519. Noted June 13.

Maryland — State Roads Comn., Baltimore, graveling 4 mi. Contr. P-94, Prince George Co., to W. W. Buck, Upper Marlboro, $27,586. Noted July 9.

Maryland—State Roads Comn., Baltimore, graveling 5 mi. Contr. P-93, Prince George Co., to Jarboe & Haughton, Mechanicville, $34,451; 1.5 mi. Contr. AA-62, Anne Arundel Co., to J. I. Smink, Brooklyn, $18,665. Noted July 11.

Massachusetts—Dpt. P. Wks., State House, Boston, bituminous macadam paving 6,600 ft. Medway, to Iron Trap Rock Co., Woonsocket, R. I., $40,057—4,750 ft. Lexington, to J. A. Gaffey & Son, 19 Curtis St., Medford, $35,271—27,671 ft. Holyoke and Westfield, and rein.-con. paving 2,000 ft. North Adams to Lane Constr. Corp., 134 State St., Meriden, Conn., $147,102 and $74,698 respectively—gravel and bituminous macadam paving 4,900 ft. Bellingham, to J. F. Rooney, Park Bldg., Framingham, $13,477. Grand total $310,605. Noted July 18.

Mass., Boston—Dpt. P. Wks., bitulithic paving, Hurlcroft Ave., Ward 17 to M. DeMattio, 14 Rowe Pl., Roslindale—Sedalia Rd., Ward 16 to C. Struzziery, 115 Kittredge St., West Roxbury—recut granite block paving Brattle St., Ward 3, to B. E. Grant, 77 Floyd St., Roxbury—Est. $25,000 or more. Noted July 11.

Mass., Brookline — Bd. Selectmen, asphalt paving Harvard St., to Warren Bros. Co., 38 Charles River Rd., Cambridge. Est. $25,000. Noted July 18.

Mass., Brookline—Grading, surfacing Alberta, Goodnough, Shaw, Walnut Hill, Wallis Rds. and Wolcott Road Extension, to Edw. O'Toole Sand & Gravel Co., Everett St., Norwood. Est. $25,000 or more.

Mich., Detroit—Stone curbing, 3½ in. sheet asphalt on 8 in. concrete paving 5 sects. Evergreen Ave., to Detroit Asphalt Paving Co., 909 Transportation Bldg., $322,368.

Minn., St. Paul — For 3 in. brick paving South Wabash St., between Mississippi River Bridge Channel St., to Fielding & Shepley, 216 University Ave., $28,462. Noted July 11.

Mo., Clayton—St. Louis Co. Court, Court House, grading, 6,900 sq.yds. North and South Rd., to Kunze Constr. Co., 5926 Scanlon Ave., St. Louis, $46,112; concrete paving 5,666 sq.yd. Forsythe Blvd., to Ansboro-Maguire, Title Guaranty Bldg., St. Louis, $14,881. Noted July 18.

Mo., Clayton—St. Louis Co. Court, Court House, grading, rein.-con., paving 11,400 ft. Bayless Ave., Weber Rd., to Flinn Paving Co., 1405 South 1st St., St. Louis, $87,507. Noted July 11.

Mo., Kansas City—For 2 in. asphaltic concrete on 8 in. concrete paving 27th St. and Roanoke Rd., to Midwest Paving Co., 20th and Summitt Sts., $29,812 and $26,326 respectively; concrete paving Hickman Mills Rd., to Mullins & Hughes, 203 Nelson Bldg., $35,498. Grand total $91,671.

Mo., Springfield—Concrete paving Walnut St., to E. V. Koch, 702 North Pearl St., Joplin, $6,125—Monroe St., to Garrett Constr. Co., 211½ East Commercial St., $3,102—widening, guttering Cherry St., to F. X. Baron, 411 West Lynn St., $6,126—Oklahoma natural asphalt resurfacing 8,800 sq.yds. Cherry St., to G. G. Roudebush & Co., 6th & Walker Sts., Kansas City, Kan., at $1.70 per yd.

Mont., Butte—Concrete paving Harrison Ave., to J. C. Maguire, Butte, $49,594, bids Aug. 17.

New Jersey—State Hy. Comn., Trenton, paving Black Horse Pike, Glouster Co., to F. L. Grant, West Chester, Pa., $400,993. Noted July 11.

N. J., Englewood—Bd. City Council, Municipal Bldg., grading, paving Elmore Ave., Audubon, Fountain, Robin, Arch, and Hutchinson Rds., to G. M. Brewster & Son, 253 West Fort Lee Rd., Bogota, est. $25,000. Noted Jan. 17.

N. J., Lyndhurst (br. Rutherford)—Bd. City Comrs., City Hall, grading, concrete paving Court and Livingston Aves., to A. Weyersberg, 634 Valley Brook Ave., $17,172. Noted July 18.

N. J., Newark—Bd. Freeholders Essex Co., Court House, grading, 7 in. penetration macadam paving Broad St., to Franklin Contg. Co., 20 Washington Pl., $37,100.

N. J., New Brunswick—Bd. City Comrs., City Hall, sheet asphalt on concrete paving to Utility Constr. Co., 5 Spring St., Jones Ave., $47,094; Codwise Ave., $23,057; Bishop Pl., $27,543. Grand total $97,694. Noted June 20.

N. Y., Brooklyn—J. J. Byrne, pres., Brooklyn Boro, Boro Hall, to D. J. McCoy Asphalt Co., Avenue U and East 57th St., asphalt paving Bay St. $8,122—to B. Turecamo Contg. Co., New Cropsey Lane, East 52nd St. $11,845; Fenimore St, $14,358; Rutland Rd. $11,002; Avenue L $6,066; 13th Ave., $4,617; East New York Ave. $7,270—to Uvalde Asphalt Paving Co., 1 Bway., New York Farragut Rd. $42,174—to C. Bennett Impvt. Co., Inc., regulating East 55th St. $2,484—to Castle Bros., Inc., Johnson Pl., Fenimore St. $7,850—to J. Casalino, 211 North 7th St., Flatlands Ave. $8,774—to C. & R. Contg. Co., 2266 Gravesend Ave., 14th Ave. $2,017—to J. C. Dempsey, 516 Prospect Ave., Flatlands Ave. $28,227—to G. P. McDermott, 1770 Carroll St., Avenue L $2,871—to J. Monohan, 1921 Morris Ave., New York, Vermont Ave., $4,260. Grand total $147,597. Noted July 11.

N. Y., Brooklyn—W. R. Herrick, pres. Park Comn., Arsenal Bldg., Central Park, New York, Lincoln Terrace Playground to B. Turecamo, Contg. Co., New Cropsey Lane, $36,504; improving Ocean Parkway, to Foley & Pizzo, $3,234; Prospect Park S. W. and constructing concrete benches to J. A. Ambrosio, $14,565 and $5,980 respectively. Grand total $60,283. Noted July 18.

N. Y., Buffalo—Bd. Supervs. Erie Co., County Hall, heavy foundation paving approaches to Bridge Project 22, to Bruno Cefali, South Wales St., East Aurora, $24,000. Noted July 11.

N. Y., Little Falls—J. F. Newitt, city clk., curbing, paving 13 streets, to T. Coluccio & Sons, Rome, $109,241. Noted July 25.

N. Y., St. George—J. A. Lynch, pres. Richmond Boro, to Trifoglio, Constr. Co., granite paving Richmond Terrace $16,919; sidewalks on Targee St., $6,725; and sewer in Bryant Ave., $5,692. Grand total $48,686. Noted July 11.

N. D., Grand Forks—Concrete paving 4,100 lin.ft., Skidmore Rd., 30 ft., to Northern Constr. Co., Grand Forks, $43,076. Noted May 16.

O., Akron—Constructing Sand Run Parkway, to C. O. Quillan, Akron, $35,500.

O., Cleveland—Sheet asphalt paving 5,700 sq.yd. Lee Rd. 12, and paving Maple St., to Highway Constr. Co., Terminal Tower, $27,788 and $21,819 respectively, est. $35,700 and $27,000 respectively; macadam asphalt paving Sprague Rd. 8, to Freshwater Constr. Co., Davis & Farley Bldg., $110,690. Grand total $160,297.

Okla., Cherokee — Grading, concrete paving 29,000 sq.yds., to Highway Constr. Co., Daniels Bldg., Tulsa, $90,048. Est. $94,000.

Streets and Roads (Continued)

Okla., El Dorado—For 6 in. concrete paving 12,150 sq.yds. in paving Dist. 3, to Asplund Constr. Co., Enid. Est. $45,600.

Okla., Hooker — Grading, paving 5 blocks Swem St., to E. W. Baker & Co., Perrine Bldg., Oklahoma City. $30,200.

Pennsylvania—State Hy. Comn., Harrisburg, grading 123,000 cu.yd. Fayette Co., to Williamson Constr. Co., Turtle Creek, $142,963—concrete paving 11,660 sq.yd. Washington Co., to Hardy & Rankin, Canonsburg, $92,214—29,550 sq.yd. Delaware Co., to Benj. Foster Co., 20th and Venango Sts., Phila., $113,363—36,400 sq. yd. Elk Co., to Chas. H. Fry Constr. Co., Erie, $187,275—36,500 sq.yd. Clearfield Co., to J. S. Teeter, Taneytown, Md., $205,266—49,000 sq. yd. Allegheny Co., to J. Lee Plummer, Johnstown, $281,907—33,200 sq.yd. Fayette Co., to Georges Constr. Co., Uniontown, $157,151 — 25,300 sq.yd. Washington Co., to Dorsey Constr. Co., Findlay, O., $191,559—27,038 sq.yd., Tioga Co., to Sherman & Rhodes, Glenville, $133,405 —38,500 sq.yd., Erie Co., to Clements & Orr, Mt. Gilead, O., $138,141. Grand total $1,613,244. Noted July 4.

Pa., Beaver—For 7 in. rein.-con. paving 10,650 sq.yd. River Rd., to H. R. Allen Bell Constr. Co., 930 3rd St., $30,000.

Pa., Duquesne—City Council, grading, brick paving 2,500 ft. Duquesne Blvd., to McCrady Bros., Braddock, $120,421.

Pa., Ellwood City—L. W. Monroe, boro mgr., 228 6th St., constructing and repairing sidewalks for year 1929, day labor.

Pa., McKeesport—**Curtiss Flying Service**, grading 420,000 cu.yds. flying field, to R. M. Netherland Co., Maloney Bldg., Pittsburgh, $185,000.

Pa., Mt. Lebanon—Grading, curbing, asphaltic concrete paving, Seneca and Markham Drs., Purchase Pl., to Southern Constr. Co., Hargrove St., Pittsburgh, $80,250.

Pa., Phila.—Dpt. P. Wks., Bureau Hys., A. Murdock, dir., City Hall Annex, to Barber Asphalt Co., Hunting Park Ave. and E St., asphalt paving (assessment work), Tabor St., $2,542; asphalt resurfacing (heater method), Group 5 $29,086; Group 7 $29,900—to Union Paving Co., 123 South 21st St., Group 4 $28,686; Group 8 $30,093; Group 12 $29,253—to Eastern Asphalt Co., Penn Bldg., Group 6 $28,199; Group 9 $30,985—to Municipal Constr. Co., Washington Square Bldg., Group 11 $30,184; Group 10 $25,245. Grand total $264,773. Noted July 18.

Tex., Brownwood—Graveling 43 mi. May-Blake, Elknia and Thrifty-Truckham Rds., to Crouch & Noland, Strawn, $48,995.

Tex., Fort Worth — Brick paving 1¼ mi. Hemphill St. to Thurber Constr. Co., 1811 Ft. Worth Natl. Bank Bldg., $137,708; 1 mi. Berry St. to General Constr. Co., 414 Capps Bldg., $94,635.

Tex., San Antonio—City, to Southwest Bitulithic Co., 302 Castro St., 1¼ in. bitulithic on 9 in. rock paving 8 blocks Cincinnati Ave, $57,790; 9 in. macadam paving 20 blocks Zarzamora St., $74,307; 8 blocks Salado and North Leona Sts., $30,163—to Uvalde Rock Asphalt Co., Frost Bldg., Uvalde rock asphalt on 9 in. macadam paving 11 blocks North Zarzamora St. $45,238. Grand total $207,498.

Utah, Ephraim—City Council, guttering concrete paving, Main St., to Alston & Hogan, Beason Bldg., Salt Lake City. $20,484. Est. $26,300.

Utah, Provo—City Comn., grading, curbing, 6 in. rein.-con., paving 26,000 sq.yd. 1st North, 2nd West, 1st West, 2nd South Sts., to Christensen, Jacob & Gardner, Vermont Bldg., Salt Lake City, $57,292. Est. $70,122.

Utah, Salt Lake City—City Comn., concrete paving 28,100 sq.yd., 17th South St., to Christensen, Jacob & Gardner, Vermont Bldg., $85,869. Est. $106,443. Noted July 4.

Wash., Seattle—Paving 15th Ave. N. W., to Fiorito Bros., 3950 6th St. N. W., $77,592.

W. Va., Wellsburg—City Council, concrete paving Main St., to W. H. Armstrong Contg. Co., Fairmount, $53,900.

Ont., Hamilton—Concrete paving King St., day labor under supervision W. L. McFaul, city engr. $80,000.

Ont., Sandwich—Concrete paving 5 streets, to S. P. West, Sandwich St., $63,000. Est. $65,000.

EXCAVATION, DRAINAGE, IRRIGATION, LEVEES, RIVER AND HARBOR

Proposed Work

Calif., Bakersfield—Buena Vista Storage Dist., P. A. Dunford, secy., irrigation canal, laterals, to carry water from Kern River for irrigation purposes of district. $175,000.

Tex., San Antonio—City, c/o C. M. Chambers, mayor, soon takes bids flood prevention, incl. 500 lin.ft. concrete lining river between Nueva and Guenther Sts., rein.-con. walls, and 2 railway bridges near Guenther St. $175,000. Hawley & Freese, Frost Bldg., engrs.

Ont., Erieau — **Harwich Twp. Council**, reclaiming 1,200 acres inundated land, constructing new dikes, sheet piling; drains. $70,000. G. A. McCubbin, Chatham, engr.

Bids Asked

La., Alexandria — Aug. 26, by Bd. state engineers, 213-215 New Orleans Court House, New Orleans, rein.-con. flood gate culvert, dike and pumping plant, in mouth of Bayou Rapides, Rapides Parish; incl. 26,000 cu.yd. excavation; 16,300 cu.yd. back-fill; 52,000 cu.yds. dike or levee embankment, 609 foundation piles.

La., Shreveport—Aug. 13, by Comrs. Caddo Parish, Court House, cleaning, 140 mi. improved drainage canals and arteries incl. 12,300 cu.yd. excavation.

Mich., Detroit—Aug. 14, by H. W. Busch, comr. Dpt. Parks & Blvds., 735 Randolph St., 697 ft. rein.-con. seawall, Memorial Park. Contr. 4. $35,000. P. A. Fellows, City Hall, engr.

Ont., Goderich—Aug. 9, by S. E. O'Brien, secy. Dpt. P. Wks., Ottawa, dredging, $150,000.

Ont., Toronto—Aug. 14, by Toronto Harbour Comrs., Fleet St., J. G. Langton, genl. mgr., concrete Harbour Head Walls, Sect. 8, $100,000. J. G. R. Wainwright, c/o owners, engr.

Contracts Awarded

Calif., Westley — West Stanislaus Irrigation Dist., concrete lining 300,000 sq.ft. canal, to Wm. Cohrs, Tracy, at $0.052 per sq.ft.; 2,500 tons rock and sand, to California Rock Co., Mills Bldg., San Francisco, $1.10 per ton f.o.b. Westley.

La., Breaux Bridge—Comrs. Coulee Nicholas Gravity D. D. 5, removing 300,000 cu.yd. drainage canals, to J. W. Gibbs, Lafayette, at $0.185 per cu.yd. Noted July 11.

Mass., Barnstable—Dpt. P. Wks., dredging 14,000 cu.yd. entrance channel of Cotuit Harbor, to W. E. Burke, 36 Bromfield St., Boston, $9,115.

Mass., Vineyard Haven—Town Bd. Selectmen, bulkhead and shoring up land, to C. W. Blakeslee & Sons, 58 Waverly St., New Haven, Conn. Est. $25,000 or more.

Pa., McKeesport—See "Streets and Roads."

Ontario—Dpt. P. Wks., Parliament Bldgs., Ottawa, shore protection, at Point Maitland, to Cameron & Phin, Welland, $23,059; dredging, Sarnia, to Canadian Dredging Co., Midland, $19,200; dredging Sydenham River, to Wallaceburg Sand & Gravel Co., Wallaceburg, $18,397; dredging Parry Sound, to Randolph MacDonald Constr. Co., 1130 Bay St., Toronto, $14,332. Grand total $74,988. Noted June 6.

Ont., Brockville—Dpt. P. Wks., Ottawa, removing 78,000 cu.yd. shoals in St. Lawrence River, to I. P. Porter & Sons, St. Catherines, at $3.89 per cu.yd.

Ont., Fort William—S. E. O'Brien, secy. Dpt. P. Wks., Ottawa, dredging, to Great Lakes Dredging & Constr. Co., Ottawa, $71,354. Noted June 6.

FEDERAL GOVERNMENT

Bids Asked

Colo., Leadville — FISH HATCHERY, etc.— Aug. 20, by Bureau of Fisheries, Wash., D. C., 1½ story, 35 x 65 ft. frame fish hatchery; also frame cottage.

Conn., New London — GYMNASIUM — Aug. 14, by U. S. Coast Guard, 14th and E Sts., Wash., D. C., frame gymnasium, building and accessories, at U. S. Coast Guard Academy.

D. C., Wash.—ELEVATOR PLANTS—Aug. 30, by Treas. Dpt., at office Supervising Archt., Wash., D. C., complete elevator plants for Administration Bldg., Dpt. Agriculture and for Internal Revenue Building. J. A. Wetmore, acting superv. archt.; adv. E. N.-R. Aug. 8.

D. C., Wash.—GENERATOR—Aug. 12, by U. S. Coast Guard, 14th and E Sts., N. W., 3 diesel engine drive generators.

Fla., Key West—METAL WORK—Aug. 26, by Superintendent of Lighthouses, shipping point metal work for 10 light towers.

Fla., Miami—BULKHEAD, etc.—Aug. 29, by U. S. Engineer Office, Jacksonville, bulkhead and dock, at U. S. Reservation, South Miami Beach. Noted May 23.

Fla., St. Petersburg—DREDGING—Aug. 26, by U. S. Engineers Office, Jacksonville, hydraulic dredging off Pinellas Point, near light in Tampa Bay.

Md., Baltimore—GATES, etc.—Aug. 23, at office Supervising Archt., Wash., D. C., new gates, driveway, betterments, at U. S. Immigration Station.

Mass., Haverhill—POST OFFICE—Sept. 6, by Treas. Dpt., at office Supervising Archt., Wash., D. C., U. S. Post Office, J. A. Wetmore, Wash., D. C., acting superv. archt.

Mass., Northampton—ROAD—Aug. 13, by U. S. Veterans' Bureau, Arlington Bldg., Wash., D. C., constructing and resurfacing road at U. S. Veterans' Hospital.

Mo., Jefferson Barracks—QUARTERS—Sept. 3, by U. S. Veterans' Hospital, one N. P. Building, one M. O. C. Residence and two duplex personnel houses, incl. roads, walks and grading, at U. S. Veterans' Hospital.

N. Y., Brooklyn—PILES—Sept. 10, by Signal Supply Officer, Signal Sect., New York General Depot, 58th St. and 1st Ave., wood, creosoted yellow pine, 30, 18, 35 and 40 ft.

N. Y., Fire Island — PIER — Aug. 12, by Superintendent of Lighthouses, St. George, creosoted piles and untreated timber deck pier, at Fire Island Light Station.

N. Y., New York—ADDITION—Aug. 27, by U. S. Veterans Hospital, Arlington Bldg., Wash., D. C., addition and refrigeration alterations, to building 1, U. S. Veteran's Hospital.

N. Y., St. George — BUOYS — Aug. 26, by Superintendent of Lighthouses, 4 whistle buoys, 16 bell buoys, 56 various riveted nun and can buoys, 327 various welded can and nun buoys, 190 pcs. c.i. sinkers and bottom castings.

Tenn., Memphis—EARTHWORK—Aug. 19, by U. S. Engineer Office, 2,153,000 cu.yd. earth work in Upper St. Francis Levee Dist., on Bird's Point Floodway. Noted Aug. 1.

Utah—BRIDGES—Aug. 20, by U. S. Dpt. Interior, Natl. Park Service, Ogden, constructing 2 bridges, 1 concrete culvert, and grading and improving East Rim Rd., Project 1-A-1, within Zion Natl. Park, Washington Co., R. J. Finch, dist. engr.

Utah and Wyoming—WELLS—Aug. 10, by Superintendent of Lighthouses, Salt Lake City, pumping equipment for 5 deep wells, on Salt Lake-Omaha Airways, between Salt Lake City, Utah and Cheyenne, Wyo.

Bids Received

Calif., Livermore — INFIRMARY — U. S. Veteran's Bureau, Arlington Bldg., Wash., D. C., addition to infirmary building, from E. K. Nelson, 77 O'Farrell St., San Francisco, $18,700 (180 days).

Calif., San Francisco — HOSPITAL — Constructing Quartermaster, July 29, hospital ward, Letterman General Hospital, from Young & Horstmeyer, 461 Market St., San Francisco, $34,253; plumbing and electrical work, from Dean Constr. Co., $6,585 and $1,943 respectively. Noted July 4.

Colo., Denver—ROAD—Bureau P. Rds., improving and constructing East Entrance Rd., from Morrison-Knudson Co., Boise, Idaho, $340,991.

Ill., Murphysboro—WATER SUPPLY—Treas. Dpt., at office Supervising Archt., Wash., D. C., water supply, piping at U. S. Post Office from C. A. Martindell, 7359 Ogontz Ave., Phila., Pa., $2,191. Noted July 10.

Kan., Leavenworth—DIKES, etc.—U. S. Engineer Office, Kansas City, Mo., 3,000 ft. pile clump dikes, 13,600 lin.ft. standard revetment, from Massman Constr. Co., 519 American Bank Bldg., Kansas City, Mo., $381,280. Noted July 11.

Kan., Oak Mills—REVETMENT—U. S. Engineer Office, Postal Telegraph Bldg., Kansas City, Mo., July 17, 20,350 lin.ft. standard revetment, Bean Lake Bend, Missouri River, from Woodhead Bros. Constr. Co., 132 South 13th St., Lincoln, Neb., $394,200. Noted June 26.

Mo., St. Louis—TOWBOATS—Aug. 20, by Inland Waterways Corp., Munitions Bldg., Wash., D. C., steel towboats, new type, for use on Mississippi River and Tributaries.

N. J., Oceanport—QUARTERS—Constructing Quartermaster, Fort Monmouth, July 24, 4 family apartments and bachelors officers Quarters building, from G. H. Evans, 1416 Vine St., Phila., Pa., $324,840. Noted July 4.

N. Y., Brooklyn — POST OFFICE — Treas. Dpt., at office Supervising Archt., Wash., D. C., constructing foundations for extension to U. S. Post Office, Court House, from H. B. Green, Inc., 303 West 42nd St., New York, $248,700. Noted July 11.

O., Dayton—DIKE—Aug. 14, by Constructing Quartermaster, 2,600 lin.ft. earth and rock dike, at Wright Field.

Tex., Randolph Field (mail San Antonio) — QUARTERS, etc.—Aug. 29, (extended date), by Constructing Quartermaster, 47 double non-commissioned officers quarters; five 1 story and three 2 story field officers quarters; fourteen 1 story and forty-six 2 story company officers quarters; 1 quartermaster and 1 air corps warehouse, five 250 men air corps barracks, and one 300 men air corps barracks, all with utilities. Noted July 25.

Va., Harrisburg—REMODELING—Treas. Dpt., at office Supervising Archt., Wash., D. C., remodeling and enlarging U. S. Post Office from Nielson Constr. Co., Harrisonberg, $14,170. Noted July 4.

Wash., Walla Walla—ROAD—U. S. Veteran's Bureau, Arlington Bldg., Wash., D. C., roads at U. S. Veteran's Hospital, from Standard Asphalt Paving Co., 522 Cedar St., Spokane, $16,568. Noted June 26.

Alaska, Sitka—HEATING SYSTEM—Treas. Dpt., at office Supervising Archt., Wash., D. C., July 24, heating system, at U. S. Custom House, from Bergh-Griggs Co., 936 Commerce St., Tacoma, Wash., $4,400. Noted July 4.

Contracts Awarded

Calif., San Diego—STEAM DISTRIBUTION SYSTEM—Spec. 5933—Bureau Yards & Docks, Navy Dpt., Wash., D. C., improving steam distribution system at Naval Operating Base, to Pemberton Heating & Ventilating Co., 105 Macy St., Los Angeles, $16,148 (150 days); heating in Building 36 and water softener in Bldg. 30 to Thomas Haverty Co., 316 East 8th St., Los Angeles, $5,761 (120 days).

Colo., Fort Lyon—GAS and OIL BURNING EQUIPMENT—U. S. Veterans' Bureau, Arlington Bldg., Wash., D. C., gas and oil burning equipment, to Colorado Interstate Gas Co., Box 1087, Colorado Springs, $14,653.

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Federal Government (Continued)

D. C., Wash.—ALTERING—U. S. Veterans Bureau, Arlington Bldg., altering clinic building, at Mt. Alto, to Martin Bros., 1341 Connecticut Ave. N. W., $5,541.

O., Cincinnati—EXTENSION—Treas. Dpt., at office Supervising Archt., Wash., D. C., extending mezzanine at Custom House and Post Office to David Gordon Bldg. Co., Burnet and Northern Aves., $14,568 (120 days). Noted July 25.

Idaho, Boise—REMODELING—Treas. Dpt., at office Supervising Archt., Wash., D. C., remodeling U. S. Post Office and Court House to Charles Weitz Sons, 713 Mulberry St., Des Moines, Ia., $350,000. Noted July 25.

Md., Annapolis—REROOFING—Spec. 5862—Bureau Yards & Docks, Navy Dpt., Wash., D. C., reroofing dome, Chapel, Naval Academy, to D. M. Andew Co., Sisson and 26th St., Baltimore, $46,200 (150 days).

Mo., St. Louis—REPAIRING—Treas. Dpt., at office Supervising Archt., Wash., D. C., repairing U. S. Marine Hospital, to W. Pearce, Salina, Kan., $6,965.

Wash., Seattle—BARRACKS—Spec. 5977—Bureau Yards & Docks, Navy Dpt., Wash., D. C., addition to North and South wings on Barracks at Naval Air Station to Commission Constr. Co., 5107 Arcade Bldg., $43,000.

Nev., Fallon—APPROACH—Treas. Dpt., at office Supervising Archt., Wash., D. C., approach work at Post Office to T. W. Cissell, Bethlehem, Pa., $4,100. Noted June 26.

RAILWAYS

Proposed Work

Colorado — Missouri Pacific Railroad Co., E. A. Hadley, ch. engr., St. Louis, Mo., relaying 85 mi. 90 pound steel rails, between Lolita and Kansas-Colorado line, steel contract to Minnequa plant, Colorado Fuel & Iron Co., Pueblo. Total est. $500,000.

Mo., St. Louis—City, Wabash Ry. Co., M. F. Longwill, ch. engr., St. Louis, Mo., and Chicago, Rock Island & Pacific Ry. Co., W. H. Peterson, ch. engr., Chicago, Ill., relocation and depression of tracks of above railroads adjacent to and through Forest Park, constructing rein.-con., viaduct, X-type to carry Union and Lindell Blvds. and Grand Dr. in park over railroad tracks. $480,000. L. R. Bowen, City Hall, engr. Noted Mar. 9.

Ontario—Canadian Pacific Ry., Windsor Sta., Montreal, Que., J. M. R. Fairbairn, ch. engr., double tracking 7 mi. between Sudbury and Azilda, incl. ballasting, new ties, new rails, track laying, etc. $75,000.

Ontario—Canadian Pacific Ry., Windsor Sta., Montreal, Que., J. M. R. Fairbairn, ch. engr., radial brick chimney and cinder disposal plant, Ottawa; section houses at Meath and Adelaide; new bunk house, remodelling station, extending machine shop, cinder disposal plant, new 100 ft. turntable, Smiths Falls; new stations at Kemptville, Lachute, and Wakefield; extending machine shop, North Bay; 150 ton track scales, Prescott; radial brick chimney, Chalk River; remodelling stations at Buckingham Junction, Bedell, Finch, Green Valley, Hammond, Renfrew and Vankleek Hill. $1,000,000.

Ont., Sudbury—Canadian Pacific Ry. Co., Windsor Sta., Montreal, Que., J. M. R. Fairbairn, ch. engr., 1 story, rein.-con., to Angus & Taylor, North Bay. Est. $300,000. Noted Mar. 21.

Contracts Awarded

Ont., Hamilton—Toronto, Hamilton & Buffalo Ry. Co., James and Hunter Sts., general contract concrete, brick, steel round house and repair shop, to Dominion Constr. Co., Reford Bldg., Toronto; boilers to Leonard Boiler Co., York St., London; coal and ash handling equipment, to Roberts & Shaver Co., 400 North Michigan Blvd., Chicago, Ill.; air compressor, to Canadian Pneumatic Tool Co., 767 St. Antoine St., Montreal, Que.; steel water tank, to Horton Steel Co., Northern Ontario Bldg., Toronto. Total est. $850,000.

GRADE CROSSINGS

Proposed Work

N. Y., Endicott — Erie R.R. Co., R. C. Falconer, ch. engr., 50 Church St., New York, plans eliminating Oak Hill Avenue Crossing, Broome Co., here. $263,300.

N. Y., Hopewell Junction—New York, New Haven & Hartford R.R. Co., E. Gagel, ch. engr., New Haven, Conn., plans eliminating Carroll and Main Street Crossings, south of here. $130,000.

N. Y., Lake George — Delaware & Hudson R.R. Co., J. MacMartin, ch. engr., Albany, plans eliminating Dowlings crossing, near here. $100,000.

Ont., Windsor—City and Canadian Pacific Ry., Windsor Sta., Montreal, Que., J. M. R. Fairbairn, ch. engr., concrete, rein.-con. and steel subway under tracks at Ellis Ave. $50,000. H. C. McMordie, King Bldg., engr. for city.

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Ont., Windsor—East Windsor and Canadian Natl. Ry. St., James St., Montreal, Que., C. S. Gzowski, ch. engr., concrete, steel subway under tracks on Drouillard Rd. $272,000. H. W. Patterson, City Hall, East Windsor, engr.

Bids Asked

Ont., Weston—Aug. 12, by T. T. Irving, ch. engr. Canadian Natl. Ry., New Union Sta., Toronto, rein.-con., steel subway on Weston Rd. under Canadian Natl. Ry. $40,000. Noted May 9.

Contracts Awarded

Mass., Lawrence—Boston & Maine R.R. Co., W. J. Backes, ch. engr., Boston, rein.-con., steel underpass, Osgood St., to New England Constr. Co., Circuit Ave., Springfield. Est. exceeds $25,000.

TUNNELS AND SUBWAYS

Proposed Work

New York — Bd. Transportation, J. H. Delaney, chn., 49 Lafayette St., New York, plans surveys vehicular tunnels, from 34th and 42nd Sts., Manhattan to Brooklyn and Long Island City. $103,000,000. $2,000,000 voted for preliminary work.

Bids Received

N. Y., Long Island City—Bd. Transportation, J. H. Delaney, chn., 49 Lafayette St., New York, Aug. 2, Sect. 5, Route 108, Rapid Transit R.R. under Queens Blvd. from Petit Pl., to 55th Ave. from G. W. Flynn, 17 Battery Pl., New York. $4,882,000. Noted July 25.

N. Y., New York—Bd. Transportation, J. H. Delaney, chn., 49 Lafayette St., Aug. 2, constructing railroad duct line Route 104, part 53rd St. and East River Rapid Transit R.R. from Knight & DeMicco, 4197 Park Ave., $228,000. Noted Aug. 1.

N. Y., New York—Bd. Transportation, J. H. Delaney, chn., 49 Lafayette St., installing block signal and interlocking systems, for portion independent system, city subway, from Charles Meade & Co., 217 West 14th St., $3,340,000 (18 months). $3,320,000 (20 months). Noted June 13.

DAMS

Bids Asked

Calif., Ione—See "Waterworks."

Colo., Colorado Springs—Northfield Land & Water Co., 3011 North Tejon St., taking bids removing 8,000 cu.yd. from dam, 25 mi. northwest of here. J. Field, Kittredge Bldg., Denver, engr.

Contracts Awarded

Conn., Wallingford—R. Wallace & Sons Mfg. Co., repairing concrete dam, to Barbara & D'Aurio Co., 51 Leavenworth St., Waterbury. $14,076.

AIRPORTS

Proposed Work

Calif., Sacramento—City plans hangars at airport, Freeport Blvd. $30,000. B. C. Clark, city engr.

Conn., Glastonbury—Town, c/o H. B. Waldo, plans airport.

N. Y., Jamestown — North American Lloyd Aircraft, 535 5th Ave., New York, bids in September airport, incl. hangars, shops, $100,000. F. D. Amory, Jr., 551 5th Ave., New York, engr.

Okla., Heavener — H. Z. Ward, preliminary plans airport. $30,000. Private plans.

Okla., Lawton—City, T. Sanders, clk., soon takes bids airport hangar. $175,000.

Tex., San Antonio—Aviation Corp., G. B. Grosvenor, pres., 122 East 42nd St., New York, plans by K. Francine, New York, university of the air plant, incl. administration building, two 110 x 200 ft. brick hangars, 80 x 100 ft. general repair shop, brick, and concrete dormitory and mess hall, four 3,500 ft. runways, taxiway, etc. Est. $250,000.

Contracts Awarded

Mich., Detroit—Dpt. P. Wks., general contract main hangar at city airport, to W. E. Wood Co., 1805 Ford Bldg., $609,500. Noted July 25.

Pa., McKeesport—See "Streets and Roads."

Pa., Pittsburgh — Curtis Airports Corp., 29 West 57th St., New York, general contract airport addition, hangars, school, etc., Bettis Airport, to Stone & Webster, 120 Bway., New York. Est. exceeds $500,000.

POWER AND LIGHTING

Proposed Work

N. Y., New York—A. Goldman, comr. Plant & Structures, Municipal Bldg., rejected bids July 22, high and low tension feeder system, on Queensboro Bridge. Noted July 18.

North Carolina—Carolina Power & Light Co., Raleigh, P. A. Tillery, mgr., plans extending power line 15 mi. between Sanford and Carthage. Private plans.

Texas—Central Power & Lighting Co., c/o Frost Bldg., San Antonio, making surveys, 85 mi. 66,000 volt transmission line between Asherton and Laredo; also substation at Laredo. $100,000. Private plans.

Texas—Panhandle Power & Light Co., Borger, making surveys, 11 mi. 13,000 volt line from Stinnett to Cabot & Co., Inc., plant, at Dorger. $33,000. Private plans.

Contracts Awarded

Calif., Oakland—Electrolier system on Grand Ave., Lakeshore, Lake Park, to Western States Constr. Co., Russ. Bldg., San Francisco. $51,000.

Conn., Waterbury—Connecticut Light & Power Co., 111 West Main St., altering, service and office building, Freight St., to United Eng. & Constr. Inc., Broad and Arch Sts., Phila., Pa. Est. $100,000.

N. Y., Marcy—Dpt. Mental Hygiene, Capitol, Albany, service connections incl. electrical work for Utica State Hospital, to W. A. Williams, Inc., 325 Catherine St., $38,000. Noted June 13.

Okla., Miami—For one hundred forty-five 16 ft. steel lighting standards on Main St. and Central Ave., to Union Metal Co., Canton, O., est. $25,000. Noted Apr. 4 under "Unclassified."

SPORTS AND PARKS

Proposed Work

Fla., Miami Beach—Fisher Properties, soon lets contract 40 x 120 ft. swimming pool, lounge, locker rooms, filtration plant and pump room.

Ind., Terra Haute—See "Schools."

Mass., Beverly — Corporation being formed, soon takes bids 1 story, 65 x 128 ft., brick, steel, indoor tennis court, incl. dressing room, concrete found., Essex St. $50,000. G. Hadden, 607 5th Ave., New York, archt.

Mass., East Boston (sta. Boston)—City, Park Dpt., Boston, improving World War Memorial Park. $75,000 appropriated.

N. Y., New York—Dpt. Parks, W. R. Herrick, pres. Park Bd., Arsenal Bldg., Central Park, plans by J. F. Dusenbury, c/o Park Dpt., 2 story, 63 x 163 ft., brick recreation building, Jerome Ave. and 164th St. Est. $150,000.

N. Y., Penn Yan—F. E. Getchel & Co., plans 6,000 acre playground and summer resort.

N. J., Jersey City—Bd. City Comrs., City Hall, revised sketches by C. H. Ziegler, engr. and archt., 26 Journal Sq., 400 x 500 ft., rein.-con. memorial stadium, Dales Ave. and State Highway. $1,000,000. Noted July 18.

O., Youngstown—City plans concrete circular swimming pool 60 ft. diam., 7-10 ft. deep, filter plant. $30,000. G. F. Turner, City Hall, engr.

Tex., San Antonio—Terrell Wells Inc., c/o J. J. Nix, Travis Bldg., plans rein.-con. swimming pool. Est. $25,000. Private plans.

Bids Asked

Mich., Detroit—Aug. 14, by H. W. Busch, comr. Dpt. Parks & Blvds., 735 Randolph St., 94 or 106 rein.-con. boat wells and foot bridge on pile found. in Memorial Park. $300,000. P. A. Fellows, City Hall, engr. Noted Apr. 4 under "Unclassified."

Miss., Jackson—Aug. 14, by H. C. Roberts, chn. Bd. Trustees, 145 East Capitol St., gymnasium at Deaf & Dumb Institute.

N. J., Bogota—Aug. 13, by Bd. Educ., School 2, filling and grading athletic field, east side Hackensack River. $25,000. R. Schweizer, Administration Bldg., engr. Noted Mar. 21.

Tex., San Antonio—City, c/o C. M. Chambers, mayor, taking bids at Riverside Park Golf course, draining, ditching, etc. $60,000. I. Ewig, city hall, city engr.

Contracts Awarded

Fla., Miami Beach — Roney Plaza Hotel, swimming pool, to H. Hunt, 1636 S. W. 9th St., Miami.

Mass., North Easton—Town of Easton, L. A. Frothingham Memorial Park, incl. 2 playgrounds, ¼ mi. cinder track, baseball diamond, wading pool, grading, Sheridan and Walnut Sts., to Stone and Webster Corp., 49 Federal St., Boston.

N. Y., New York—W. R. Herrick, pres. Park Comn., Arsenal Bldg., Central Park, general contract tennis house, comfort station, Central Park, to E. A. and R. J. Moore. $59,943; plumbing, to Max Spool, 180 5th Ave., $7,468. Noted July 18.

Pa., Pittsburgh—City, 40 x 90 ft. swimming pool, 2 story, basement, 40 x 100 ft., brick bath house, to Welsh Constr. Co., 2331 Los Angeles Ave.

Pa., Pittsburgh — City, swimming pool, and bath houses, to Welsh Constr. Co., 2331 Los Angeles Ave., Pittsburgh. $33,407. Est. $35,500.

UNCLASSIFIED

Proposed Work

GAS LINE—California—Western Natural Gas Co., Balfour Bldg., San Francisco, granted permit, construct gas line between Kettleman-Hills field, near Bakersfield, and Tracy; also branches to Richmond and Sacramento. $2,000,000.

COMFORT STATION—Attleboro, Mass.—City, A. Gehrung, chn. health com., plans by O. M. Higgins, Park St., 1 story, irregular sized, brick, concrete, steel. Park St. $25,000. Noted Apr. 11.

WAREHOUSE and **GRAIN ELEVATOR—Kansas City, Mo.**—Chatterton & Sons, Capitol Natl. Bank Bldg., Lansing, Mich., warehouse, 75 x 250 ft.; grain elevator, 36 x 60 ft., 140 ft. high. Private plans.

CRANE RUNWAY—Brooklyn, N. Y.—E. W. Bliss Co., 53rd St. and 2nd Ave., plans by F. E. O'Rourke, 29-28 Hunters Point Ave., Long Island City, 1 story, 41x200 ft., metal crane runway. 53rd St. and 1st Ave.

FREIGHT TERMINAL—Oklahoma City, Okla.—Oklahoma City, Ada & Atoka Rwy. Co., G. B. Treat, ch. engr., Oklahoma City, freight terminal. $60,000.

Pennsylvania—See "Streets and Roads."

TELEPHONE LINE — Troup, Tex. — Gulf States Telephone Co., c/o F. G. Almond, mgr., Troup, plans 14 mi. rural telephone line, incl. post, wires, etc. Private plans.

MIXING PLANT—Vancouver, B. C.—L. M. Deither Coal Co., concrete mixing plant on Granville Island. $40,000.

QUARRY PLANT—Vinemount, Ont.—Canada Crushed Stone Corp., Dundas re-equipping quarry plant destroyed by fire, $100,000 loss.

Bids Asked

COAL POCKETS and **TRESTLE—Hoboken, N. J.**—Delaware, Lackawanna & Western R.R. Co., G. J. Ray, chn. engr., Terminal Bldg., taking bids general contract brick, rein.-con. coal pockets and trestle, Henderson St. $250,000. Noted June 20 under "Contracts Awarded."

Contracts Awarded

STAGE — Universal City, Calif. — Universal Pictures Corp., 140 x 340 ft., steel, to Meyer Bros., 142 North Toluca St., Los Angeles. $56,161. Est. $60,000.

SERVICE CONNECTIONS, ETC.—Poughkeepsie, N. Y. — Commissioner Dpt. Mental Hygiene, Capitol, Albany, service connections for nurses' home, infirmary, and staff apartments for Hudson River State Hospital to R. H. Baker Co., Inc., 101 Park Ave., New York, $29,400; electrical work, to Erickson Eng. Co., 452 Lexington Ave., New York, $18,385. Noted June 13.

DRAINAGE STRUCTURES—Austin, Tex.—Travis Co., concrete drain structures in Defined Road Dist. 5, to J. F. Johnson, 3rd and Red River Sts., $20,626; timber tile trestle bridges on same road, to Johnson Bros., 101 Sparks Ave., $6,282.

MATERIALS

Proposed Work

PIPE—Inglewood, Calif.—City rejects bids, will purchase in open market, 5,500 ft. 4 in. c.i. pipe.

Bids Asked

BARS, STEEL SHEETS, etc.—**Phila., Pa.**—Aug. 16, by C. E. Walsh, purchasing agt., Penn. R.R. Co., 15 North 32nd St., bars, shapes plates, Contr. 36; steel sheets, Contr. 37; steel wheels, Contr. 38.

ELECTRIC SIGNS—Pittsburgh, Pa.—Aug. 19, by Dpt. P. Safety, J. M. Clark, dir., 908 City-County Bldg., 6 electrically illuminated flashing traffic street signs.

Bids Received

GRANITE BLOCK, etc.—**New York, N. Y.**—J. Miller, pres. Manhattan Boro. Municipal Bldg., July 31, 50,000 granite blocks from Terminal Supply Co., 2 Lafayette St., $5,762—3,000 cu. yd. sand from Colonial Sand Co., 551 5th Ave., $5,700—600 tons asphaltic joint filler from Standard Oil Co. of New York, $10,054—and 15,000 cu.yd. asphalt from Z. Mahoney, 430 Carroll St., Brooklyn, $15,750. Noted July 25.

Contracts Awarded

ROCK, SAND and **GRAVEL—Oroville, Calif.**—Butte Co., 24,050 tons to Coast Rock & Gravel Co., 111 Sutter St., San Francisco, $21,480; 6,050 tons, to Johnson Rock Co., Chico, $12,945.

ROCK, etc.—**Oroville, Calif.**—Butte Co., 30,000 tons crushed rock for road work, to Johnson Rock Co., Chico, $6,933, and to Coast Rock & Gravel Co., San Francisco, $21,480. Noted June 27.

ROCK and SAND — Westley, Calif. — West Stanislaus Irrigation Dist., 2,500 tons each crushed rock and concrete sand, to California Rock Co., Mills Bldg., San Francisco, $5,250.

PAVING MATERIALS—Atlanta, Ga.—Fulton Co., to Birmingham Slag Co., Walton Bldg., slag at $1.80, $1.90, $2.05 and $2.30 per ton; to Atlanta Aggregate Co., 721 Augier Ave. N. E., crushed stone at $1.40 per ton; to De Jarnette Supply Co., 1001 Boulevard N. E., cement at $2.16 per bbl.; to Alabama Sand & Gravel Co., Montgomery, Ala., gravel, at $1.80 per ton; to S. E. Finley, 292 North Ave. N. W., asphalt.

PIPE—Chicago, Ill.—For 1,668 ton c.i. water pipe to Glamorgan Pipe & Fdry. Co., Lynchburg, Va., 3 in. at $55.05 per ton; 4 in., $48.05, 8 and 12 in., $45.05.

PIPE—Kansas City, Mo.—For 510 tons 10 in. c.i. water pipe, to National Cast Iron Pipe Co., 603 Land Bank Bldg., $4,740.

BITUMINOUS CONCRETE—St. George, N. Y.—J. A. Lynch, pres. Richmond Boro. Boro Hall, July 17, 1,500 tons bituminous concrete on Dist. 1, 2 and 3 to Vanbro Constr. Co., 24 Elizabeth St., West New Brighton, $19,350. Noted July 11.

FOREIGN

Chili and Peru—Republic of Chili (Santiago) and Republic of Peru (Lima) having plans and engineering surveys made after Oct. 1 by Frederick Snare Co., 114 Liberty St., New York, for port development in Arica Harbor. Noted June 13.

Buildings

RESIDENTIAL

(Apartments unless otherwise noted)

Bids Asked

Calif., Los Angeles—Owner, c/o C. C. Fry, archt., 1510 North Kenmore Ave., taking subbids, 4 story, 83 x 153 ft., brick apartment, Valley Blvd. and Hobart Ave. $180,000.

Ill., Chicago—P. F. Olsen, archt., 720 Cass St., taking bids 13 story, basement, 100 x 156 ft., brick, rein.-con., 52nd St. and Blackstone Ave., for J. H. Cundy, c/o archt. $2,000,000. Noted June 6.

Mass., Dorchester (sta. Boston)—Owner, c/o M. Louis, archt., 73 Cornhill, Boston, taking bids 4 story, basement, 75 x 120 ft., brick, plain found., 245 Talbot Ave. $160,000.

Mass., Lynn—See "Contracts Awarded."

Mass., Pittsfield—Aug. 12, by Longfellow Inn, W. T. Butler, pres., 6 story, 115 x 220 ft., brick, steel, concrete, hotel, South and Reed Sts. $700,000. Hart & Shape, 247 Park Ave., New York, archts., and J. MacA. Vance, 24 North St., associate archt. Noted Aug. 1.

Mich., Detroit — S. Plotkin, 604 Lafayette Bldg., taking bids and open same about Aug. 15, 11 story, basement, 200 x 275 ft., concrete, brick, steel, stone, plain found., East Jefferson Ave. M. H. Finkel, 153 East Elizabeth St., archt.

N. J., Convent—Myers, Bigelow & Shanley, archts., 24 Walnut St., Newark, bids about August 15, general contract 4 story, basement, brick, steel, nuns' home, plain found., for College of St. Elizabeth, Convent Station. $300,000. Noted July 11.

N. J., Freehold—Bd. Freeholders Monmouth Co., Court House, takes bids about Aug. 7, 2 story, basement, brick, steel, plain found., $250,000. L. Cubberly, 133 Morris Ave., Long Beach, archt. Noted Feb. 14 under "Allenwood."

N. Y., Brooklyn—See "Contracts Awarded."

N. Y., Long Island City — See "Contracts Awarded."

N. Y., New York—Denberry Corp., 101 Park Ave., bids about September 1, general contract 10 story, 30 x 96 ft., brick, steel, hotel, 132 East 64th St. Y. Matsiu, 101 Park Ave., archt. Noted July 25.

Pa., Phila.—See "Contracts Awarded."

Contracts Awarded

Calif., Oakland—L. & S. Properties Co., Russ Bldg., San Francisco, 6 story, basement, steel, concrete, to Pacific Coast Building Co., 14th St., Oakland, $175,000.

Calif., Palm Springs — Owner, c/o architect and contractor, 2 story, 204 x 252 ft., brick, concete, hotel, to J. M. Cooper, Rives-Strong Bldg., Los Angeles, $250,000.

Calif., Riverside — Eden Hot Springs Co., group of hotel buildings, stucco, timber, Eden Hot Springs, to C. E. Nay, 3009 Jewel Ave., Los Angeles, $500,000.

Calif., Riverside—Owner, c/o architect and contractor, 2 story, 204 x 252 ft., concrete hotel, Palm Springs St., to J. M. Cooper Co., Inc., Rives-Strong Bldg., Los Angeles. Est. $250,000.

Calif., San Francisco—M. B. Clipper, Hearst Bldg., 6 story, basement, rein.-con., steel, 45th Av. and Point Lobos, day labor. $150,000.

Conn., Hartford—N. Levitzky, 120 Acton St., 6 story, 90 x 125 ft., brick apartment and store, Evergreen St. and Farmington Ave. $200,000. Owner builds. J. Gelman, 721 Main St., archt.

Ind., Indianapolis—J. Friedman, general contract 2 story, brick, steel, 2517-2525 Shelby St., to Unversaw & Miller, 1155 South West St., Indianapolis. Est. $150,000.

Mass., Lynn—Galis Realty Co., 23 Central Ave., 4 story, basement, brick, plain found., Baker St., separate contracts. $160,000. G. A. Cornet, 7 Munroe St., archt.

N. Y., Brooklyn — W. M. Calder Co., 2703 Avenue U, 2 story, brick, timber, East 43rd St. and Farragut Rd., separate contracts. $150,000. J. A. Boyle, 367 Fulton St., archt. Noted Aug. 1.

N. Y., Brooklyn—Norek Constr. Co., 66 Court St., 4 story, 100 x 110 ft., brick, timber, 14th Ave. and 58th St., separate contracts. $200,000. H. J. Nurick, 44 Court St., archt. Noted July 25.

N. Y., Brooklyn—H. Rapps, c/o Rieva & Ungarleider, archts., 186 Remsen St., 6 story, 93 x 200 ft., brick, timber, 36th St., separate contracts. $300,000. Noted Aug. 1.

N. Y., Long Island City—Boulevard Operators, Inc., 160-09 Jamaica Ave., Jamaica, two 6 story, 95 x 100 ft., brick, timber, 21st St. and 24th Dr., separate contracts. $350,000. Kavy & Kavovitt, 350 Stone Ave., archts. Noted Aug. 1.

N. Y., Long Island City — Woodstock Co., 191 2nd Ave., 6 story, 87 x 112 ft., brick, 41st St. and Bway. Separate contracts. $200,000. C. Wiest, 32-02 30th Ave., Astoria, archt. Noted Aug. 1.

N. Y., New York — Active Properties Co., H. S. Lupschitz, pres., 9 East 40th St., apartment, 264 West 75th St. to H. R. H. Constr. Co., 9 East 40th St. Est. $2,500,000.

O., Canton—O'Nesto Hotel Co., 231 32nd St. N. W., 13 story, basement, 64 x 100 ft., concrete, brick, steel, stone hotel, to H. L. Stevens Co., 30 North Michigan Ave., Chicago, Ill., $600,000. Noted Aug. 1.

Pa., Phila.—D. Brown, 4800 North 7th St., two 4 story, basement, 42 x 67 and 42 x 133 ft., brick, steel apartments, plain found., 57th and Oxford Sts., separate contracts. $500,000. Stetler & Dysher, 709 Chestnut St., archts.

Pa., Phila. — D. J. Freedman, 5701 North 17th St., 4 story, basement, 44 x 161 ft., brick, steel, plain found., Grange and 17th Sts., separate contracts. $175,000. Private plans.

Pa., Phila.—W. Freehofer, 20th and Indiana Sts., 4 story, basement, 92 x 99 ft., brick, steel, plain found., to N. S. Ludwig, 4432 Frankford Ave. Est. $185,000.

Pa., Phila. — Surrey Lodge, Inc., Franklin Trust Bldg., 4 story, basement, irregular shaped, rein.-con., brick, steel, plain found., 43rd and Locust Sts., separate contracts. $350,000. D. Supowitz, 230 South 15th St., archt.

Wis., Milwaukee—Grossman & Cohen Realty Co., 105 Wells St., 8 story, 51 x 75 ft., 12th St., to Pfeiffer Constr. Co., 586 66th Ave.

Wis., Milwaukee—Victor Realty & Finance Co., M. P. Fox, pres., 123 Wisconsin St., 3 story, basement, 127 x 215 ft., brick, tile, Teutonia Ave., to B. Wilke, 1917 Oakland Ave., Milwaukee.

Ont., Toronto—H. McLean, owner and general contractor, 3244 Yonge St., 6 story, basement, concrete, brick, steel, McNairn Ave., separate contracts. $250,000. W. C. Charters & Son., 26 Queen St. E., archts.

CLUBS

Proposed Work

N. J., Plainfield—Watchung Valley Country Club, Warrenville Rd., bids about September, revised plans 2 story, basement, brick, steel, Warrenville Rd. $150,000. C. C. Wendehack, 101 Park Ave., New York, archt. Noted Aug. 1.

Bids Asked

Mass., Attleboro—Ezekial Bates Lodge, G. Bliven, 7 County St., taking bids 4 story, 70 x 118 ft., brick, stone temple. $200,000. W. T. Arnold, Journal Bldg., Meriden, Conn., archt. Noted July 18.

N. J., Hackensack—C. V. R. Bogert, archt., 210 Main St., taking bids 3 story, basement, brick, steel, plain found., 2nd near Susquehanna Sts., for American Legion, 20 Bridge St. $150,000. Noted Aug. 1.

N. J., Perth Amboy—Fourth Ward Polish Citizens Club, bids about Sept. 1, general contract 3 story, basement, 50 x 100 ft., brick, steel, Elm St. $150,000. E. Wierzbicke, 302 Hall Ave., archt. Noted July 4.

Contracts Awarded

N. J., Boonton—Knoll Golf Club, c/o Walker & Gillette, archts., 369 Lexington Ave., New York, general contract to Carlson Co., Walnut St., Montclair. Est. $150,000. Noted July 18.

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Clubs (Continued)

O., Cleveland—Natl. Town & Country Club, G. G. G. Peckham, pres. 1900 East 24th St., 2½ story, basement, concrete, brick, steel, to Thompson-Starrett Co., 250 Park Ave., New York. Est. $2,300,000. Noted Jan. 31 under "Buildings, Commercial."

HOSPITALS

Proposed Work

Ill., Chicago—St. Elizabeth Hospital, 1433 Claremont Ave., plans by H. J. Gaul, 228 East Superior St., 8 story, 48 x 200 ft., brick, stone, addition, $500,000. Noted Apr. 4 under "Buildings—Commercial."

Mass., Middleton — Comrs., Essex Co. Court House, Salem, revised plans by Ashton Huntress & Aller, 477 Essex St., Lawrence, altering and constructing 3 story, basement, 30 x 325 ft., brick, steel addition, plain found., Maple St. Est. exceeds $150,000. Former bids rejected. Noted July 18 under "Buildings—Commercial."

Mass., Worcester—Worcester City Hospital, C. O. Anderson, chn., plans brick, steel hospital group. Est. to exceed $150,000. Engineer and architect not selected.

Mo., Kansas City—Trinity Lutheran Hospital, 36th and Wyandott Sts., plans by H. C. Eckland, 609 Gumbel Bldg., 5 story, basement, 44 x 120 ft., brick, stone addition, $175,000.

N. J., Allenwood—L. Cubberly, archt., 210 Bway., Long Branch, soon lets contract 1 story, basement, brick, steel, plain found., for Allenwood Sanitarium. $150,000.

N. Y., New York—Lenox Hill Hospital, 100 East 77th St., plans by York & Sawyer, 100 East 42nd St., hospital, 1082 Lexington Ave. $5,000,000.

Bids Asked

Mass., North Reading—Aug. 14, by Commonwealth of Massachusetts, Dpt. P. Health, State House, Boston, 2½ story, basement, 40 x 200 ft., brick, admitting and isolating building, incl. power house, plain found., at state sanatorium, $175,000. Stevens & Lee, 45 Newbury St., Boston, archts. Noted May 16.

Mass., Roxbury (sta., Boston) — Children's Hospital, 1300 Longwood Ave., taking bids 6 story, basement, 45 x 100 ft., brick, steel, physotherapy unit, Longwood Ave. $250,000. Coolidge, Shepley, Bulfinch & Abbott, Ames Bldg., Boston, archts. Noted Jan. 31.

Mich., Jackson — Aug. 19, by Supervisors, Jackson Co., 3 story, basement, 66 x 140 ft., rein.-con., brick, steel, stone sanatorium, plain found., Lansing and Erie Sts. $170,000. A. C. Allen, 402 Dwight Bldg., archt. Noted Apr. 11 under "Buildings Commercial."

Mo., Kansas City — Greenbaum, Hardy & Schumacher, assoc. archts., 216 Scarrett Bldg., taking bids 9 story, basement, irregular shaped, rein.-con., brick, steel, for Schloss Memorial Hospital, c/o assoc. archts. $1,500,000. Noted May 10.

N. Y., New York — One Thousand Eight Hundred Fifteen Morris Avenue, Inc., N. Kraemer, pres., 145 East 176th St., taking bids general contract hospital, Henwood and Morris Aves. $250,000. Block & Hesse, 18 East 41st St., archts. Fall & Snyder, 183 Madison Ave., structural engr. Noted Mar. 21.

O., Cincinnati—Aug. 19, by Hamilton Co. Hospital Building Comm., Court House, 7 story, basement, 54 x 159 ft., rein.-con., stucco, plain found., Guerley Rd. $540,960. Sam Hannaford & Sons, 1024 Dixie Terminal, archts.

Pa., Warren—Aug. 23, by Commonwealth of Pennsylvania, c/o B. E. Taylor, secy. Property & Supplies, additions to reception service building, Erie Fisher Wood & Co., 233 Oliver Ave., Pittsburgh, archts.; adv. E. N.-R. Aug. 8.

Wis., Milwaukee—Aug. 14, by Dpt. P. Wks., 2 story, basement, Johnston Emergency Hospital, 108 x 116 x 152 ft., brick, steel, plain found., 8th Ave. C. Malig, City Hall, archt.

Contracts Awarded

Ill., Galesburg—Sister Superior Camille, St. Mary's Hospital, 5 story, basement, 45 x 80 x 80 ft., brick, rein.-con. addition, to R. H. Heintzen, Normal. Est. $150,000. Noted July 18.

Mass., Westboro—Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, altering and constructing 2 story basement, brick, stone, steel addition, concrete found., at state hospital, to E. E. Munroe, 62 Spring St., Plainville. Est. $150,000. Noted July 18 under "Buildings, Commercial."

N. J., Englewood—Englewood Hospital, 4 story, brick, steel hospital and nurses' home, to White Constr. Co., 95 Madison Ave., New York. Est. $500,000. Noted Apr. 4.

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CHURCHES

Proposed Work

Calif., Pasadena — Lake Avenue Congregational Church, Lake Ave. and Maple St., plans by Marston and Maybury, 25 South Euclid Ave., Lake Ave. $200,000.

Conn., Manchester—J. L. Russell, chn. building com., soon lets contract brick parish house and school, for Center Congregational Church, W. Woodruff, pastor. $200,000. Hutchins & French, 11 Beacon St., Boston, Mass., archts. Noted May 2.

N. Y., Brooklyn—Thomas Aquinas Parish, J. T. Kehoe, pastor, 2000 Flatbush Ave., plans by W. P. McGovern, 156 East 42nd St., New York, 66 x 189 ft. church, and 3 story, 52 x 75 ft. rectory, $325,000.

N. Y., Larchmont — Larchmont Avenue Church, Howell Park, bids in October, church and Sunday School, $150,000. P. R. Pope, 542 5th Ave., New York, archt. O. E. Goldschmidt, 116 West 39th St., New York, engr.

Okla., Tulsa—First Christian Church, sketches 2 story, basement, Denver St. $250,000. Engineer and architect not elected.

Bids Asked

D. C., Wash.—St. Gabriels Parish, c/o Maginnis & Walsh, archts., Statler Bldg., Boston, Mass., taking bids 1 story, basement, brick, stone church. Est. $150,000.

Contracts Awarded

Calif., Pasadena — First Baptist Church, 4 story, brick, rein.-con., steel church, Union St. and Marengo Ave., to Wm. Crowell, 495 South Bway. $235,000.

Ill., Mundelein—Catholic Bishop of Chicago, 719 Cass St., Chicago, 3 story, brick faculty house, to W. J. Lynch Co., 844 Rush St., Chicago. Est. $500,000. Noted June 6.

Ind., Michigan City — Trinity Episcopal Church, 614 Franklin St., 2 story, brick, incl. parish house and auditorium, to Tonn & Blank, Michigan City. Est. $200,000. Noted July 4.

Me., Portland—St. Peter's Roman Catholic Church, T. DeMingo, pastor, 1 story, basement, 90 x 105 ft., brick, stone, plain found., to A. Galli & Son, 377 Stevens Ave. Est. $150,000. Noted July 18 under "Buildings—Educational and Religious."

Mass., Salem—Grace Episcopal Church, c/o W. H. Ritter, archt., 1588 Beacon St., Brookline, 2 story, basement, brick, stone church addition and auditorium, plain found., to G. H. Williams, Whipple Ave., Danvers. Est. $150,000. Noted July 25 under "Buildings, Educational and Religious."

Mass., Whitinsville — Christian Reformed Church, c/o G. E. Dorman, archt., 6 Beacon St., Boston, 1 story, basement, 75 x 100 ft., brick, plain found., to P. G. DeArmond & Son, 54 West Main St., Westboro. Est. $150,000. Noted July 11.

N. Y., Brooklyn—Central Methodist Church, 120 Lafayette Ave., 100 x 165 ft. church, to William Kennedy Constr. Co., 215 Montague St. Est. $750,000. Noted July 25.

Pa., Pittsburgh—C. W. Larson, archt., 612 Fordham St., 2 story, basement, 90 x 115 ft., stone, Wylie and Develliers Sts., to W. B. Hartley Constr. Co., 8th Ave., Homestead, for Ebenezer Baptist Congregation, P. J. King, pastor, 9 Jumilla St. Est. $250,000.

Pa., Pittsburgh — Mt. Washington United Presbyterian Congregation, A. A. Love, pastor, 22 Prospect Ave., 2 story, basement, 40 x 127 ft. and 24 x 40 ft., brick, stone, incl. parsonage, concrete found., Bailey Ave. and Mt. Washington St., to Grange Riffle Co., Clark Bldg. Est. $150,000.

Pa., Swissvale — First Methodist Episcopal Congregation, P. Lindberg, pastor, 2024 Braddock Ave., 2 story, basement, 116 x 116 ft., brick, steel, hollow tile Braddock Ave. and Dickson St., to Hodder Constr. Co., 817 Talbott Ave., Braddock. $125,000. Est. $200,000.

SCHOOLS

Proposed Work

Calif., Redlands—Redlands University, plans by Marsh, Smith & Powell, 514 Architects Bldg., Los Angeles, 3 story, basement, 98 x 142 ft., steel, concrete university building, university campus. $150,000.

Conn., Milford—Town, O. W. Platt, supt. Schools, new high school. $150,000. Engineer and architect not selected.

Conn., Stamford—City, School Bd., plans new brick, steel grade or junior high school. $150,000 or more. Engineer and architect not selected.

Conn., Waterbury—St. Ann's Roman Catholic Parish, plans by E. H. LaRiviere, West Main St., 2 story, basement, brick, grade and high school. $150,000.

Conn., Westport — Town, M. Lefler, supt., schools, plans 2 story, basement, brick, steel, Bridge St. $150,000. Engineer and architect not selected.

Ind., Lebanon—School Comrs., plans by C. Beeson, Crawfordsville, brick, steel, school and gymnasium, $150,000.

Ind., South Bend—School Comrs., plans by E. W. Young, 807 Sherland Bldg., brick, steel, elementary school and gymnasium, Eddy and Monroe Sts. $250,000 and $175,000 respectively.

Ind., Terre Haute—School Comrs., sketches by G. J. Stoner & Co., Terra Haute, 2 story, basement, brick, rein.-con., junior high school, Lafayette and Beech Sts., $200,000; physical education and community auditorium, Maple and Garfield Aves. $225,000.

Ill., Chicago—Sisters of Charity of Blessed Virgin Mary, Dubuque, Ia., sketches by J. W. McCarthy, 139 North Clark St., 16 story girls' college on 175 x 258 ft. site, Sheridan Rd. near Devon Ave. $1,000,000. Noted Dec. 20, 1928.

Ia., Sioux City — Sisters St. Francis, 645 Davis St., Dubuque, plans by Steele & Hilgers, United Bank Bldg., 3 story, basement, 50 x 150 ft., rein.-con., girls' college, plain found., Briarcliffe St. $200,000.

Mass., Boston—See "Contracts Awarded."

Mich., Dearborn—Bd. Educ., plans by B. C. Wetzel & Co., 2317 Dime Bank Bldg., Detroit, 2 story, basement, 70 x 210 ft., rein.-con., brick, steel, plain found., Superior Blvd. $200,000.

Mich., East Detroit — Bd. Educ., plans by Warren S. Holmes Co., 500 Capitol Savings & Loan Bldg., Lansing, 3 story, part basement, 120 x 175 ft., rein.-con., brick, steel, stone, plain found. $190,000.

Minn., Northfield—St. Olaf College, plans by Coolidge & Hodgson, 134 South La Salle St., Chicago, Ill., 3 story basement, brick, rein.-con., dormitory. $150,000.

Miss., Greenville—Bd. Educ., H. W. Sterling, pres., bids after Aug. 15, 2½ story, basement, brick, stone, steel, concrete high school incl. auditorium, gymnasium, cafeteria on 180 x 184 ft. site. $225,000. N. W. Overstreet, Mississippi Fire Insurance Bldg., Jackson, archt. Noted Aug. 1.

Mo., Maryville—Bd. Educ., R. P. Hosmer, pres., rejected bids 2 story, basement, 74 x 139 ft., brick, rein.-con., stone grade school, $150,000. Felt, Dunham & Kriehn, 300 West 47th St., Kansas City, archts. General contract 2 story addition to high school, to G. F. Constr. Co., Exira, Ia. Est. $35,000. Noted Apr. 25.

N. Y., Jordon—Bd. Educ., plans 3 story high school. $225,000.

Pa., Blairsville—Bd. Educ., J. D. Thompson, pres., plans by H. M. Rogers, Johnstown Trust Bldg., Johnstown, high school. $200,000.

Pa., Donora—Bd. Educ., sketches by C. C. Compton, high school. $300,000. Noted Apr. 4 under "Buildings Educational."

Tex., Denton—North Texas State Teacher's College, sketches memorial tower on campus. $250,000 funds being raised for same.

Wis., Fond du Lac—Bd. Educ., plans by F. J. Stepnoski, 104 South Main St., Lincoln High School addition, 2 story, basement, 88 x 108 ft., rein.-con., brick, steel, plain found.

Bids Asked

Calif., San Diego—Aug. 19, by Bd. Educ., 3 story, 94,000 sq.ft., rein.-con. El Cajon Ave. T. C. Kostner, Spreckles Theatre Bldg., archt. Noted June 13.

Conn., East Hartford (br. Hartford) — Aug. 12, by St. Mary's Roman Catholic Parish, T. J. Drennan, pastor, 2 story, basement, 70 x 140 ft., brick, steel, Main St. $200,000. D. Guerriero, 1029 Main St., Hartford, archt. Noted June 13.

Ind., Beaver Dam (mail Akron)—Aug. 10, by School Comrs., 2 story, 100 x 120 ft., brick, steel school, Franklin Twp., Kosciusko Co., $150,000. Bradley & Babcock, 221 West Wayne St., Ft. Wayne, archts. Noted July 11.

Ind., Wolcottville — Aug. 17, by School Comrs., 2 story, 90 x 118 ft., brick, steel hollow tile high school, Johnson Twp., La Grange Co., $150,000. Bradley & Babcock, 221 West Wayne St., Ft. Wayne, archts. Noted July 11.

Ia., Council Bluffs—Aug. 14, by State Bd. Educ., W. H. Gemmill, secy., 2837 Kingman St., Des Moines, 2 story, brick, concrete, stone, incl. north wing addition to cottage, also industrial, engineering equipment and waterworks, South Ave. for Iowa School for Deaf. $290,000. Proudfoot, Rawson, Sourers & Thomas, 810 Hubbell Bldg., Des Mones, archts. Noted Oct. 4, 1928.

Kan., Concordia—Aug. 20, by Bd. Educ., G. Troup, clk., 2 and 3 story, basement, 194 x 215 ft., rein.-con., brick, stone, high school, $275,000. Proudfoot, Rawson, Sourers & Thomas, 810 Hubbell Bldg., Des Moines, Ia., archts. Noted July 24.

Kan., Leavenworth—St. Mary's Academy, c/o Sisters of Charity, taking bids 4 story, base-

Schools (Continued)

ment, 121 x 212 ft., brick, stone, rein.-con., academy. M. Carroll, 713 Linwood Blvd., Kansas City, Mo., archt. Noted Aug. 1.

Me., Orono—University of Maine, H. Boardman, taking bids girls dormitory, home economics and infirmary buildings; also addition to library, all brick, plain founds. To exceed $150,000. Cromwell & Lancaster, Exch. Bldg., Bangor, archts. Noted July 11.

Mass., Belmont (br. Boston)—Aug. 20, by Town Bd. Selectmen and H. T. Underwood, archt., 46 Cornhill, Boston, 3 story, basement, irregular sized, brick junior high school addition, Washington and Oakley Sts. $260,000. Noted Aug. 1.

Mass., Easton—Town, c/o McLaughlin & Burr, archts., 88 Tremont St., Boston, taking bids 2 story basement, brick, Oliver Ames High School addition, plain found., Lincoln St., North Easton Section. $200,000.

Mass., Scituate — Town, c/o McLaughlin & Burr, archts., 88 Tremont St., Boston, taking bids altering and constructing 3 story, basement, brick addition, plain found., Central St. $150,000 to $160,000. Noted May 23.

Mich., Detroit—Aug. 16, by C. A. Gadd, bus. mgr. Bd. Educ., 1354 Broadway Ave., 3 story, basement, 100 x 188 ft., rein.-con., brick, steel, stone, plain found., Hubbell Ave. $558,000. Donaldson & Meier, 1188 1st Natl. Bank, archts.

Mich., Trenton—Aug. 19, by G. E. Strom, secy. Bd. Educ., Monroe, 2 story, basement, rein.-con., brick, steel, stone, plain found., incl. natatorium. Dist. 1. $150,000. LeRoy & Newlander, 123 Pratt Bldg., Kalamazoo, archts.

Mich., Ypsilanti—Aug. 17, by A. Wiard, secy. Bd. Educ., 3 story, basement, 160 x 169 ft., concrete, brick, steel, stone, plain found. $347,000. R. S. Gerganoff, 206 North Washington St., archt. Noted Apr. 4 under "Buildings—Educational."

N. J., Clifton—Bd. Educ. High School, taking bids general contract 3 story, basement, brick, steel addition plain found., Race Track Sect. $150,000. Lee & Hewitt, 152 Market St., Paterson, archts. Noted June 13.

N. J., Irvington (br. Newark)—R. J. Reilly, archt., 12 East 41st St., New York bids about August 15, general contract 2 story, basement, school and convent, Madison and Myrtle Aves, for St. Leo's Parish, J. O. Buchmann, 103 Myrtle Ave., $200,000. Noted Aug. 1.

N. Y., Buffalo—Sept. 5, by Bd. Educ., 000 Genesee Bldg., School 67, 1711 Abbott Rd. Private plans.

N. C., Winston-Salem — Salem College, H. Rondthaler, pres., taking bids three 4 story, dormitories, campus. $200,000. H. Upjohn, Grand Central Terminal Bldg., New York, archt.

O., Portsmouth—Aug. 30, by W. G. Hazelbeck, clk. Bd. Educ., U. S. Grant High School, 2 story, basement, concrete, brick, incl. gymnasium and auditorium. $275,000. DeVoss & Donaldson, Lyric Theater Bldg., archts.

Pa., Doylestown—Natl. Farm School, S. B. Daniels, taking bids 2 story, basement, 50 x 100 ft., brick, steel, plain found., near here.

Ont., Guelph — Aug. 19, by G. Hogarth, deputy minister P. Wks., Toronto, 4 story, basement, 213 x 260 ft., concrete, stone administration buildings at Ontario Agricultural College, York Rd. F. R. Heakes, c/o Dpt. P. Wks., Toronto, archt.

Ont., Toronto—Aug. 15, by W. W. Pierce, secy.-treas., Bd. Educ., 155 College St., Duke of York School, 2 story, basement, concrete, brick, steel, stone, Pembroke St. $320,000. C. E. Dyson, College St., archt.

Contracts Awarded

Calif., Ione—Dpt. P. Wks., Div. Architecture, Sacramento, general contract rein.-con. refectory at Preston School of Industry, to D. Vexey & Son, 354 Hobart St., Oakland, $82,969. Noted June 13 under "Unclassified."

Conn., Storrs—Connecticut Agricultural College, 2 story, basement, brick, steel, limestone laboratory, to Peck McWilliams Co., 47 West Main St., Norwich. Est. $150,000. Noted June 27.

Ill., Chicago—Bd. Educ., 650 South Clark St., general contract Wright Junior High School, to W. E. O'Neil Constr. Co., 308 West Washington St., $619,319; carpentry, to G. Reininga & Co., 9051 South Halsted St., $202,240; plastering, to Balka Plastering Co., 130 North Wells St., $98,750; ventilating, to H. H. Davis Co., 4146 South Western Ave., $89,893; electrical work, to W. A. Jackson Co., 37 West Van Buren St., $126,025. Grand total $1,136,227. Noted Mar. 28.

Ind., West Lafayette (br. Lafayette)—Purdue University, 3 story, basement, brick, rein.-con., men's dormitory and union building on campus, to Lovering & Longbottom, Builders Exchange, St. Paul, Minn. Est. $150,000. Noted July 4.

Ind., Scott—School Comrs., general contract 2 story, basement, 70 x 100 ft., brick, stone, steel, La Grange Co., to F. Hershberger, Middlebury. Est. $150,000.

Mass., Boston — Commonwealth of Massachusetts, Dpt. Educ., general contract 4 story, basement, 175 x 260 ft., limestone, steel, plain found., normal art school, to J. A. Singarella, Park Sq. Bldg., $297,000; heating and ventilating, to P. A. Dolan, 237 Bway., $39,288; plumbing, to J. J. Vogel, 4273 Washington St., Roslindale, $29,362. Grand total $365,650. Rejected bids electrical work. Noted June 27.

Mass., Great Barrington — Town, c/o F. I. Cooper Corp., archts., 172 Tremont St., Boston, altering and constructing 2 story, basement, brick, stone addition, plain found., to J. W. Duff Inc., 146 Summer St., Boston. Est. $150,000. Noted May 16.

Mo., Maryville—See "Proposed Work."

Mo., Webster Groves — H. P. Hess, archt., 1001 Ambassador Bldg., 3 and 4 story, basement, 160 ft. tower, rein.-con. brick, stone preparatory seminary incl. convent, dormitory, auditorium, chapel, gymnasium near Watson Rd. at intersection Laclede Station Rd., to Mississippi Valley Constr. Co., 802 Chestnut St., St. Louis, for Catholic Archdiocese of St. Louis, c/o J. J. Glennon, 4510 Lindell Blvd., St. Louis. Total est. $1,250,000. Noted July 4. Plumbing, to T. J. Sheehan Co., 2231 Olive St., St. Louis; heating, to Elliott & Barry Eng. Co., 4060 Pine St., St. Louis.

N. J., East Paterson—Bd. Educ., Boro Hall general contract 2 story, basement, brick, steel, plain found., Gantnor Ave. to L. Infante & Sons, 64 Passaic St., Garfield, est. $150,000. Noted July 25. Heating, plumbing and ventilating to J. Galoppa, River Dr.; electrical work to Tri Service Electric Co., 929 East 28th St., Paterson; steel and iron to J. Radcliffe, 96 Prospect St., Paterson.

N. J., South Orange — Seton Hall College, South Orange Ave., general contract 2 story, basement, brick, steel, plain found., South Orange Ave. to G. D. McCarthy, 55 West 42nd St., New York, N. Y., $150,000.

N. J., Westfield—Bd. Educ., Clark St., general contract 2 story, basement, 170 x 235 ft., brick, steel, to M. Riesz, 307 Smith St., Perth Amboy, $225,000. Noted July 25. Plumbing to L. Moore, Inc., 1713 Wood Ave., Linden; heating and ventilating to G. J. Tobin, 187 North Ave., Plainfield.

N. Y., Flushing—Bd. Educ., 500 Park Ave., New York, general contract P.S. 154, to Concord Constr. Co., 476 Seneca Ave., Brooklyn, $292,000—heating to Raisler Heating Co., 129 Amsterdam Ave., New York, $56,900. Noted July 4. Plumbing to H. Homer & Son, Inc., $18,390.

N. Y., Hollis (br. Jamaica)—Bd. Educ., 500 Park Ave., New York, general contract P.S. 135, to Concord Constr. Co., 476 Seneca Ave., Brooklyn, $291,700—heating to J. H. McCann, 89 Newton Rd., Noted July 4. Plumbing to Triborough Eng. Corp., Chatham-Phoenix Bldg., Long Island City, $18,340.

N. Y., Lockport — Bd. Educ., High School, on West Avenue School site, to R. E. Stockwell, Lockport, $159,600. Noted July 18.

N. Y., New York—Bd. Educ., 500 Park Ave., general contract and electrical work, P.S. 71, to C & W Constr. Co., 400 East Fordham Rd., $185,800. Noted July 25.

N. Y., Springfield Gardens—Bd. Educ., 500 Park Ave., New York, general contract and electrical work P.S. 52, to Agostini Bros., Main St., Yonkers, $189,200. Noted July 25.

Pa., Pittsburgh—Bd. Educ., Bellefield Ave., general contract Madison Elementary School addition, to Pittsburgh Eng. & Constr. Co., 511 Homewood St., $196,813; steam heating, to Midgley Heating Co., Martin Bldg., $32,000. Noted July 11 under "Buildings Educational." Plumbing, to Moss & Blakeley, 223 Baltzhoover Ave., $13,516; electrical work, to Delmer Electrical Co., 1722 West Liberty Ave., $13,120.

S. D., Yankton—Yankton College, G. W. Nash, pres. general contract science hall, 3 story, basement, 142 x 192 ft., rein.-con., plain found., to Johnson Constr. Co., Aberdeen, $205,174; electrical work, to Electrical Constr. Co., Sioux Falls, $16,364; heating, to J. Ferris, Sioux Falls, $32,490. Grand total $254,028. Noted Apr. 25.

Ont., Hamilton—R. H. Foster, secy. Bd. Educ., City Hall, Westdale School, four 2 and 3 story, basement, rein.-con. brick, steel, stone, plain founds., to Piggott Constr. Co., Piggott Bldg., $1,020,544; heating and plumbing, to A. Clark, 7 Main St., West Hamilton. Noted June 13 under "Buildings—Educational."

Ont., Toronto—Wycliffe College, Hoskin Ave., 2 story, basement, stone library, concrete found., to Witchell & Son, 156 St. Helens Ave. Est. $150,000. Noted July 5 under "Buildings—Educational."

THEATERS

Proposed Work

Mass., Needham—W. F. Alden, c/o Wm. F. Alden Co., Great Plain Ave., sketches by Blackall, Clapp & Whittemore, 31 West St., Boston, 1 story, basement, brick, steel, plain found., Great Plain Ave. $150,000.

Mont., Anaconda—Washoe Amusement Co., A. Nadeau, mgr., plans by M. Pretica, Pantages Bldg., Seattle, Wash., brick, rein.-con., theatre, $175,000.

Bids Asked

Calif., Los Angeles—Aug. 22, by City Purchasing Agent, 107 City Hall, 182 x 316 ft., rein.-con., amphitheatre, Griffith Park, for Security 1st Natl. Bank of Los Angeles (trustees), $185,000. Noted July 25.

Ont., Galt—Syndicate, G. A. Debie, 7 Concession St., (interested) bids about Aug. 21, 1 story, basement, 75 x 161 ft., brick, steel Water St. $150,000. M. Brown, 627 Confederation Life Bldg., Toronto, archt. Noted July 25.

BANKS

Proposed Work

Conn., Hartford—Park Street Trust Co., R. M. O'Brien, pres., 617 Park St., plans by C. J. Malmfeldt, 15 Lewis St., 6 story, brick, limestone, bank and office, Broad and Park Sts. $200,000. Noted Jan. 17.

Ill., Chicago—Howard Avenue Trust & Savings Bank, Howard and Ashland Aves., plans by J. J. Jensen, 1105 Lawrence Ave., 4 story, basement, 100 x 125 ft., brick, marble, rein.-con., stone, incl. offices and stores, Howard and Malvern Aves. $500,000.

Pa., Phila. — J. J. Greenberg, Fidelity-Philadelphia Bldg., plans by P. S. Tyre, 114 South 15th St., 6 story, basement, 185 x 235 ft., rein.-con., brick, steel bank, plain found., Broad and Cambria Sts.

Ont., Toronto—Canadian Bank of Commerce, 23 King St., W. plans by Dominion Realty Co., 11 Jordan St., branch bank. $150,000.

Bids Asked

Mass., Brockton—Security Co-operative Bank, B. B. Winslow, chn. building com., 83 Main St., taking bids 1 story, basement, brick, concrete, steel, plain found., Main St. $150,000. R. E. Jackson, 106 Main St., archt. Noted June 27.

Mass., New Bedford—Luzo Corp. of America, c/o L. LeBrode, archt., Olympia Bldg., taking bids 1 story, basement, brick, limestone, steel, plain found., River and Purchase Sts. $150,000. Noted Aug. 1.

N. J., East Orange — Holmes & Winslow, archts., 153 East 38th St., New York, bids about Sept. 15, general contract 2 story, basement, brick, steel, plain found., for Ampere Bank, 227 North 18th St. Est. $150,000. Noted July 18.

Wash., Seattle—H. Bittman, archt., Securities Bldg., bids about Oct. 19, 4 story, basement, 82 x 113 ft., bank, 4th and Pine Sts., for Center Investment Co., J. C. Silverstone, $350,000.

Contracts Awarded

Ga., Atlanta — Fourth Natl. Bank, J. K. Ottley, pres., altering and constructing 15 story, basement, 73 x 110 ft., brick, steel, rein.-con., addition, plain found., to Barge Thompson Co., 136 Ellis St. Est. $750,000. Noted July 25.

Ill., Palatine—Cable & Spitz, archts., 220 South State St., Chicago, masonry contract, 2 story, 132 x 198 ft., brick, stone incl. stores, office, garage, to E. Schulenberg, Arlington Heights, for W. F. Swanson. Est. $250,000. Noted June 6.

Mo., Independence—First Natl. Bank, general contract, 6 story, basement, 42 x 80 ft. rein.-con., brick, stone, Liberty & Lexington Sts., to Bickel Constr. Co., 903 Pioneer Trust Bldg., Kansas City. Noted June 20.

N. Y., New York—Farmers Loan & Trust Co., 22 William St., bank and office, to G. A. Fuller Co., 949 Bway. Est. $4,000,000. Former contract rescinded owing to bank merger. Noted Feb. 28.

Ont., Toronto—Bank of Montreal, Yonge and Front Sts., 3 story, concrete, brick, steel, stone, St. Clair Ave. W., to Wells & Gray, Confederation Life Bldg. Est. $150,000.

OFFICES

Proposed Work

Mich., Battle Creek—Postum Co., Cliff St., office, Cliff St. $200,000.

Minn., Minneapolis — T. K. Kelly, 2548 Nicollett Ave., 8 story, basement, brick, rein.-con., incl. stores, 26th St. and Lowry Ave. N.E., $250,000.

N. Y., New York—H. Mandel Associates, 10 East 40th St., bids in August, separate contracts 18 story, brick, steel, 7th Ave. and 16th St. $750,000. Farrar & Watmough, 10 East 40th St., archts., Jaros & Baum, 116 West 39th St., New York, heating and ventilating engrs. Noted Aug. 1.

Pa., Oil City—Janssen & Cocken, archts., Century Bldg., Pittsburgh, soon lets contract 4 story, basement, 44 x 128 ft., brick, stone, concrete found., Colbert St., for Oil Well Supply Co., Clark Bldg., Pittsburgh. $165,000.

Man., Winnipeg—J. Richardson & Sons, Ltd., Grain Exchange Bldg., 16 story, rein.-con., Portage Ave. $2,000,000.

Ont., Port Arthur—Public Utilities Comm., plans by C. D. Howe & Co., Whalen Bldg., 3 or 4 story, basement, concrete, brick, steel, North Court St. $150,000.

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Offices (Continued)

Bids Asked

Pa., Pittsburgh—Sept. 1, by Gulf Refining Co., Frick Bldg., foundations for 37 story, 7th and Grant Sts. Total est. $1,000,000. Trowbridge & Livingstone, 527 5th Ave., New York, archts. Noted July 11.

Contracts Awarded

Ind., Peru—O. F. Rhodes, general contract 3 story, 135 x 145 ft., brick, steel, Wabash and Court Sts., to C. Clifton, 231 East River St. Est. $150,000.

Mass., Boston — Boston Insurance Co., 87 Kilby St., 11 story, basement, brick, limestone, steel addition, plain found., to Wm. Coulson Co., 238 Main St., Cambridge. Est. exceeds $150,000. Noted July 4.

Mo., Kansas City—Waltower Bldg. Co., c/o A. C. Wiser, archt. 1319 R. A. Long Bldg., 12 story, basement, 48 x 107 ft., brick, steel, reinforced con., 9th and Walnut Sts., to Manhattan Constr. Co., Muskogee, Okla. Est. $150,000.

N. J., Perth Amboy—G. M. Ricci, archt., 224 Smith St., awarded contract 3 story, basement, 50 x 265 ft., brick, steel, plain found., 224 Smith St., to H. L. Gascoigne, Rochelle Park, for A. Kaufman, 237 State St. Est. $150,000. Noted June 6.

Wis., Stevens Point—Childs & Smith, archts., 720 North Michigan Ave., Chicago, Ill., general contract 4 story, 130 x 130 ft. office to W. Christensen Constr. Co., 1929 12th St., Racine. Cut stone to Ingalls Cut Stone Co., Bedford, Ind., setting cut stone to Archer Stone Setting Co., 228 North LaSalle St., Chicago, Ill., lath and plastering to W. Williams, 2841 Edgewood Ave., Chicago, Ill., ventilating system to T. R. N. Gerdes, 107 Bank St., New York City, for Hardware Mutual Insurance Co. Est. $500,000. Noted May 3.

STORES

Proposed Work

Calif., Fresno — Montgomery-Ward Co., 2825 East 14th St., Oakland, 2 or 3 story, basement, Fulton St. $150,000 or more. Architect not selected.

N. J., Newark—S. Grant, c/o A. J. S. Silberstein, archt., 868 Broad St., Newark, sketches 1 story, basement, brick, steel, 653 South 13th St. $150,000.

Pa., Phila.—Owner, c/o A. Mueller, archt., 901 Walnut St., plans 2 story, basement, 110 x 150 ft., brick, steel, store and recreation, plain found., Tulpehocken and Germantown Aves. $200,000.

Bids Asked

N. Y., New York—Waterside Holding Corp., F. W. Allen, vice pres., 70 East 45th St., bids about Sept. 1, general contract 2 story, mezzanine incl. storage, stores and office, 2131 Bway., $150,000. C. Birge, 29 West 34th St., archt. Noted June 20.

Wis., Milwaukee—Starrett & Van Vleck, archts., 393 7th Ave., New York, bids about Sept. 1, general contract 7 story, top addition for T. A. Chapman Co., 125-35 East Wisconsin Ave. $1,500,000.

Contracts Awarded

Ind., Bloomington—S. S. Kresge Co., general contract, 2 story, part basement, 45 x 130 ft., brick, steel, 107 North College Ave., to C. Picke, 414 Morton St. Est. $150,000.

Ind., Indianapolis—Maco Realty Co., general contract, 2 story, basement, 105 x 210 ft. reinforced con., incl. office, College Ave. and Maple Rd., to Strathmann Constr. Co., Meyer Kiser Bank Bldg., $170,000.

Tex., San Antonio—J. C. Sullivan, c/o Sullivan Bank Bldg., altering 4 story, brick, steel, theatre building for store, incl. new elevators, to J. Westerhoff, 201 School St. $175,224. Noted Aug. 1.

LOFTS

Contracts Awarded

N. Y., New York—Varick Holding Corp., 565 5th Ave., 16 story, 172 x 188 ft., brick, steel, to W. Ginsberg, 74 Varick St., est. $1,000,000. Noted July 18.

Contractor taking bids on separate contracts.

PUBLIC

Proposed Work

Calif., Martinez — COURTHOUSE — Contra Costa Co. plans, 1st unit, $200,000 (ultimate $500,000).

Mass., Charlestown (sta. Boston)—HEALTH—City of Boston, Health Dpt., trustees of G. R. White fund, plan health unit, High and Elm Sts. Est. exceeds $150,000. Engineer and architect not selected.

N. J., Elizabeth—POLICE HEADQUARTERS—Bd. City Comrs., City Hall, rejected bids July 22, general contract, Catherine and Morrell Sts. $250,000. Noted July 11.

Pa., Pittsburgh—WELFARE—Pittsburgh Association Improving Poor, 428 Duquesne Way, soon takes bids 4 story, basement, Webster Ave. and Washington St. $275,000. E. P. Mellon, Madison Ave., New York, and Oliver Bldg., Pittsburgh, archt.

Ont., Ottawa—RESEARCH—S. E. O'Brien, secy., Dpt. P. Wks., Parliament Bldg., soon takes bids 3 story, basement, 174 x 414 ft., concrete, brick, stone research building, for Natl. Research Council, Parliament Bldgs. $2,000,000. Sproatt & Rolph, 1162 Bay St., Toronto, archts.

Bids Asked

N. H., Claremont—COURT HOUSE—Town, A. L. Fitch, chn. Bd. Selectmen, taking bids 2 story, basement, brick, stone, court house and police station, plain found., Broad St. $150,000. H. R. Beckwith, 19 Pleasant St., archt. Noted Apr. 18.

Okla., Tulsa—HISTORICAL—State Bd. of Affairs, c/o G. C. Whilard, taking bids 4 story, basement, 98 x 185 ft., reinforced con., Indiana stone granite, near State Capitol. $500,000. Layton, Hicks & Forsyth, 906 Braniff Bldg., Oklahoma City, engrs.

Contracts Awarded

N. Y., New York—HOUSE of DETENTION—Dpt. Correction, R. C. Patterson, Jr., comr., Municipal Bldg., general contract House of Detention, to Pstay & Fuhrman, Inc., 369 Lexington Ave., $1,174,000; plumbing, to J. S. Murphy Co., Inc., 1 East 42nd St., $178,886; and heating to Almirall & Co., Inc., 53 Park Pl., $116,586. Grand total $1,469,472. Noted Aug. 1.

Okla., Oklahoma City—HISTORICAL—State Bd. Affairs, Capitol Bldg., 4 story, basement, 98 x 185 ft., to Holmboe Constr. Co., 426 West 2nd St., $412,200. Noted July 4.

BUILDINGS UNCLASSIFIED

Proposed Work

N. J., Newark—JEWISH CENTER—Independent Order of Brith Abraham Admiral Sampson Lodge, L. Slutsky, 2 Osborne Terrace, will not build 3 story, basement, brick, steel, plain found. Project abandoned. Noted Feb. 28.

N. H., Manchester — HISTORICAL — Manchester Historical Society, F. P. Carpenter, pres., sketches by Tilton & Githens, 420 Lexington Ave., New York, historical building, Amherst St. $150,000.

N. Y., New York—STORAGE and RESTAURANT—Horn & Hardart Co., 600 West 50th St., soon lets contract 46 x 120 ft., 122 Pearl St. and 86 Water St., $175,000. F. P. Platt Bros., 221 West 57th St., archts. Noted July 11.

O., Shaker Heights (br. Cleveland)—COMMERCIAL and LODGE—First Catholic Slooak Ladies Union, M. Grega, recording secy., 3289 East 55th St., Cleveland, plans by Fox, Duthie & Foose, 1936 Union Trust Bldg., Cleveland, 3 story, basement, 70x100 ft., brick, Lee and Scottsdale Rds. $150,000.

Okla., Oklahoma City—AUTO HOTEL—W. E. Dixon, 1st Natl. Bank Bldg., auto hotel, 13th St. and Bway. $150,000. Engineer and architect not selected.

Pa., Pittsburgh—GARAGE—J. L. Stuart (owner and engineer), 518 Oliver Bldg., soon takes bids 2 story, 100 x 350 ft., brick, steel, stone concrete, Melwood and Denver Sts. $160,000.

Pa., Pittsburgh—AUDITORIUM—H. J. Heinz Co., 1062 Progress St., soon takes bids structural steel for auditorium, 4 story, 100 x 360 ft., brick, steel, reinforced con., Progress and Heinz Sts.; to McClintic Marshall Co., Oliver Bldg., concrete piling to Raymond Concrete Piling Co., Union Trust Bldg. Total est. $1,000,000. Noted July 11 under "Buildings—Commercial."

N. Y., New York — GARAGE, STORAGE, etc.—H. Friedman & Son Realty Co., 343 Lexington Ave., plans by C. B. Meyers, 31 Union Sq., 609 West 134th St. $175,000.

Tex., Dallas—BUSINESS—Woolf Bros. Clothing Co., 1022 Walnut St., Kansas City, Mo., plans by A. H. Gentry, March Bldg., Kansas City, Mo., 5 story, basement, 75 x 100 ft., brick, $150,000.

Tex., Fort Worth—MARKET—A. M. Owsley, 1221 Main St., Dallas, plans by Lang & Witchell, 300 Amer. Exch. Bank Bldg., Dallas, 210 x 700 ft. market building, 147,000 sq. ft. floor space, Haskell and Carroll Sts. $1,350,000.

Tex., Ft. Worth—UNION STATION—Gulf Colorado & Santa Fe Ry. Co., Merritt, ch. engr., Galveston, plans 85 x 225 ft., brick, steel, concrete found.

Tex., San Antonio—COMMUNITY CENTER—Realty Finance Co., c/o E. A. Phillips, pres., plans by H. Messick, Milam Bldg., 1 and 2 story, basement, covering 2 city blocks, Main Ave. $500,000. Noted July 1.

Ont., Toronto — WAREHOUSE — L. L. LeVeque & Co., Edgehill Rd., Columbus, O., rein.-con., Laughton Ave. $300,000.

Ont., Windsor—STATION—Canadian Natl. Ry., New Union Sta., Toronto, T. T. Irving, ch. engr., concrete, brick, steel, stone, near Windsor Terminal of Windsor-Detroit Vehicular Tunnel. $1,000,000. J. Schofield, St. James St., Montreal, Que., archt.

Bids Asked

Md., Baltimore—EXCHANGE—Aug. 9, by Taylor & Fisher, archts., Union Trust Bldg., 1 story, 50 x 152 ft., brick, steel addition, 31st St. and Guilford Ave., for C. & P. Telephone Co., Standard Oil Bldg.

Contracts Awarded

Calif., San Francisco — SALES ROOM and WAREHOUSE — Investment Properties Co., Inc., Alexander Bldg., 3 story, concrete, Howard and 9th Sts., to Industrial Constr. Co., 680 Folsom St. $150,000. Graybar Electric Co., lessee.

Kan., Newton—STATION—Atchison, Topeka & Santa Fe Ry. Co., H. W. Wagner, ch. engr., eastern lines, Topeka, 2 story, reinforced con., brick, railroad station, to M. R. Stauffer, Newton. Est. $150,000. Noted July 11.

Mass., Boston—INDUSTRIAL—Perkins Institute for Blind, 549 East 4th St., 4 story, basement, 50 x 100 ft., brick, steel, reinforced con., plain found., to C. C. Temple Co., 99 Chauncy St., Boston. Est. $150,000.

N. J., Trenton Junction—PASSENGER STATION—Reading R.R. Co., C. Dillenbeck, ch. engr., Phila., Pa., passenger station to General Contg. & Constr. Co., 133 East Front St., Trenton. $200,000. Noted Apr. 4.

O., Akron—COMMERCIAL—Ohio Bell Telephone Co., 750 Huron Rd., Cleveland, 1 story (ultimately 4 story), basement, 100 x 128 ft., Indiana limestone, West Market St., to Carmichael Constr. Co., Central Savings & Trust Bldg., $400,000.

Pa., Erie—HOME—St. Marys Home for Aged, Sisters of St. Joseph, 2 story, basement, 107 x 174 ft., reinforced con., home for aged, 26th and Ash Sts., to James J. Leach & Sons, 352 West 17th St. Est. $150,000.

Utah, Salt Lake City—WAREHOUSE—Western States Grocery Co., c/o C. C. Carpenter, 631 South 3rd West St., 2 story, basement, reinforced con., brick, plain found., to G. A. Whitmeyer & Sons Co., 2750 Grand Ave., Ogden. $217,000. Noted July 4.

Wis., Milwaukee—GARAGE—National Parking Garages, Inc., c/o H. Flood, engr., 369 Lexington Ave., New York, public garage, to Starrett Building Co., 8 South Dearborn St., Chicago, Ill. Est. exceeds $300,000.

Ont., Toronto — WAREHOUSE — Samuel & Benjamin Ltd., 470 King St. W., general contract 1 story, basement, 100 x 300 ft., concrete, brick, steel, to Geo. W. Fuller Co. of Canada, McLean Bldg.; steel, to Reid & Brown, Fleet St.; stone, to Ritchie Cut Stone Co., 191 Grant St., Hamilton; steel sash, to A. B. Ormsby Co., 150 Van Horne St. Total est. $175,000.

Industrial—Buildings

FACTORIES AND MILLS

Proposed Work

Calif., Los Angeles—Willard Storage Battery Co., East 131st St. and St. Clair Ave., Cleveland, O., plans Class A factory on 300 x 600 ft. site, 9th St. To exceed $500,000.

Calif., San Jose—Anderson Barngrover Mfg. Co., West Julian St., plans by C. W. McKenzie, Bank of San Jose Bldg., 1 story, 85 x 220 ft., brick, steel, reinforced con. assembly plant. Pleasant St. $40,000.

Conn., Bridgeport—Bassick Co., 33 Austin St., do not plan brick and steel factory. This corrects report published in July 25 issue.

Ind., Alexandria—General Insulating Co., 3 story factory addition, incl. machinery, $40,000.

Ind., Terra Haute—Quaker Maid Co. (lessee), 420 Lexington Ave., New York, soon lets contract, 6 story, basement, 100 x 175 ft., brick, steel, reinforced con. factory, Locust and Fruitridge Aves. $400,000.

Ia., Marshalltown—Marshalltown Vinegar Co., postponed indefinitely, 2 story, brick, reinforced con., factory. $200,000. McManus & Tripp, 501 Middle Dr., Indianapolis, Ind., engrs.

Ky., Louisville—Reynolds Metals Co., 30th St. and Grand Ave., plans by A. G. Tafel, 140 South 3rd St., 1 story, 140 x 216 ft., steel factory, Camp Ground Rd. Noted July 18.

Mass., South Boston (sta. Boston)—King Terminal Co., 50 State St., Boston, soon takes bids rebuilding 1 and 3 story, basement, brick, factory plain found., recently destroyed by fire. $40,000. E. E. Erickson, 50 State St., Boston, engr. Noted Apr. 11.

Mo., Maplewood—Sunnen Products Co., 6417 Dale Ave., St. Louis, soon takes bids 1 story, part basement, 120 x 168 ft., brick, reinforced con. factory, Manchester and Bartold Aves. $65,000. B. E. Elliott, Mexico, archt.

N. H., Walpole—American Mineral Products Co. Inc., 983 Main St., Hartford, Conn., plans by W. Furey, 983 Main St., Hartford, Conn., 1 story, 60 x 200 ft. brick, timber, factory. Est. exceeds $40,000.

N. J., East Rutherford (mail Rutherford) — The Flintkote Co., Maple St., plans 2 story, basement, brick, steel, plain found. $150,000. Private plans.

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Industrial—Buildings (Continued)

N. Y., Buffalo—Buffalo Courier Express, 250 Main St., plans by Monks & Johnson, 99 Chauncey St., Boston, Mass., 5 story, industrial plant, Main and Goodell Sts, $500,000.

N. Y., New York—Knickerbocker Ice Co., 41 East 42nd St., bids in September, general contract 4 story, ice manufacturing plant, 409 East 60th St, $40,000. Private plans.

N. C., Burlington—A. M. Johnson Rayon Mill Inc., W. C. Mitscherling, vice pres., plans enlarging rayon mill 4 times present size.

N. C., Fayetteville—J. W. Cone, Greensboro, S. Love, Burlington, et al., plan rayon mill, incl. 100 rayon weaving machines, to be known as Puritan-Granite-Holt Mills Co.

Okla., Tulsa—Tulsa Cement Co., c/o C. B. Douglas, Mayo Bldg., cement factory, near here, $1,800,000. Engineer and architect not selected.

O., Cleveland—Ohio Overall Cleaning Co., W. N. White, vice pres., 8008 Central Ave., plans by H. M. Morse, Finance Bldg., factory, 1 story, 42 x 107 ft., boiler house 25 x 50 ft., brick, 8008 Central Ave., $50,000.

Pa., Ellwood City—Aetna Standard Eng. Co., A. W. Paisley, secy., Ellwood City, and Home Savings & Loan Bldg., Youngstown, O., soon takes bids, 1 story, 40 x 54 ft. and 45 x 120 ft., brick, steel factory additions, $40,000.

Ont., Renfrew—Renfrew Industries Ltd., factory addition, $50,000.

Ont., Windsor—Firestone Tire & Rubber Co., Hamilton, soon takes bids brick, concrete service plant, Goyeau and Erie Sts., $100,000. Hutton & Souter, 5 James St., South Hamilton, archts.

Bids Asked

N. J., Belleville (br. Newark) — Fletcher Thompson, Co., archt., 542 Fairfield Ave., Bridgeport, Conn., taking bids general contract 2 story, basement, 180 x 300 ft., brick, steel, plain found., for Keller Mechanical Eng. Co., 70 Washington St., Brooklyn, $150,000.

N. J., Edgewater—A. Kahn, archt., 1000 Marquette Bldg., Detroit, Mich., bids about Aug. 15, rein.-con., brick, steel assembly plant, incl. wharf, oil house, water storage, etc., for Ford Motor Co., Dearborn, Mich. Noted May 23.

N. Y., New York—G. S. Williamson, engr., c/o Press Publishing Co., taking bids for newspaper printing plant, 101 East 126th St., $100,000, for M. T. Rennard, Great Neck. The New York World, lessee. Noted Aug. 1.

Tex., San Antonio — Alamo Airplane Co., c/o B. Hammond, Milam Bldg., taking bids 1st unit aircraft factory, incl. 3 buildings $200,000. Noted Aug. 1. Private plans.

Tex., Texarkana — International Agricultural Corp., Wynne-Claughton Bldg., Atlanta, Ga., and 61 Bway., New York, taking bids at Atlanta office, fertilizer plant, $750,000.

Contracts Awarded

Calif., Santa Ana — Pittsburgh Plate Glass Co., Frick Bldg., Pittsburgh, Pa., 1 story, 400 x 2,600 ft., brick, steel factory, to Stone & Webster, Laughlin Bldg., Los Angeles, $4,000,000. Noted May 9.

Conn., Beacon Falls—Homer D. Bronson Co., Beacon Falls, 2 story, 35 x 100 ft., brick, manufacturing unit, to Oscar LaCroix Constr. Co., 51 West Main St., Waterbury. Est. $45,000. Noted Aug. 1.

Conn., Stamford—Yale & Towne Mfg. Co., 200 Henry St., 2 story, brick, steel factory addition, Market St., to Vuono Constr. Co., Berlin. Est. $40,000. Noted July 25.

Ill., Barrington—Holabird & Root, archts., 333 North Michigan Blvd., Chicago, general contract 5 story, 115 x 400 ft., brick factory, to Lundorff-Bicknell Co., 100 North LaSalle St., Chicago, for Jewell Tea Co., 5 North Wabash Ave., Chicago. $1,000,000. Noted May 30.

Ill., Chicago — Victor X-Ray Corp., 223-31 South Seeley St., mason and carpentry for 5 story, 104 x 126 ft., brick factory addition, to A. Brundage, 110 South Dearborn St. Est. $150,000.

Ind., Muncie — Glascock Bros., 1515 West 15th St., three 50 x 80 ft., brick, steel factories, West 15th St., to G. Ewing & Son, 1919 West 8th St. Est. $75,200.

Ky., Louisville—U. S. Foil Co., 30th St. and Grand Ave., 2 story, 100 x 200 ft., concrete factory, own forces, $60,000. O. P. Waed, Lincoln Bldg., archt.

Md., Baltimore — Kubitz & Koeing, engrs., Emerson Tower Bldg., 1 and 2 story, 80 x 224 ft., concrete, brick, steel factory, to H. J. West, Knickerbocker Bldg., for Monumental Storage & Carpet Cleaning Co., 1110 Park Ave. Noted June 13.

Mass., Holyoke—Chemical Paper Co., R. Bosworth, 2 story, 60 x 215 ft. and 60 x 107 ft., brick, steel, concrete paper plant, to Casper Ranger Co., 20 Bond St. Est. $175,000. Noted July 4.

Minn., St. Paul—Minnesota Mining & Mfg. Co., Forest-Fauquier Sts., 2 story, basement, brick, rein.-con., addition to factory, Forest-Fauquier Sts., to W. M. Murphy & Son, 1608 Pioneer Bldg. Est. $150,000. Noted June 27.

N. J., Dunellen—Art Color Printing Co., South Washington Ave., general contract 1 story, basement, 140 x 200 ft., brick, steel, plain found., to A. Milne, 15 Watchung Ave., Plainfield. Est. $75,000.

N. Y., North Tarrytown—Chevrolet Motor Co., 3044 West Grand Blvd., Detroit, Mich., assembly plant to John W. Cooper Co., Inc., Rand Bldg., Buffalo; steel to Mahone Co., Detroit, Mich. Est. $1,500,000. Noted July 11.

N. C., Haw River — Proximity Mfg. Co., Greensboro, altering cotton mill, incl. new equipment, to Burns-Hammonds Constr. Co., Greensboro, $100,000.

Pa., Phila. — Apex Hosiery Mills, 5th and Luzerne Sts., 6 story, 65 x 120 ft. mill, to White Constr. Co., 95 Madison Ave., New York.

R. I., South Kingston (mail Kingston) — Columbia Narrow Fabric Co., North Kingston, G. P. Clark, 2 story, brick, timber, textile factory addition, $45,000. Owner builds. E. B. Whipple, 87 Waybosset St., Providence, archt.

Wis., Neenah—Kimberly Clark Co., 4 story, 104 x 122 ft., rein.-con., steel factory addition, to C. R. Meyer & Sons, 50 State St., Oshkosh.

Wis., Milwaukee — Ambrosia Chocolate Co., 331 5th St., general contract 3 story, basement, 50 x 150 ft., brick, tile, rein.-con. factory, 5th St., to Selzer-Ornst Co., 192 4th St.

Ont., Brantford—A. G. Spalding & Bros., Edward St., general contract 1 story, 50 x 161 ft. and 80 x 100 ft., brick factory, to Schultz Constr. Co., 47 Albion St., steam heating to Anguish & Whitefield, 46 Colborne St., boilers, to Waterous Engine Co. Est. $60,000.

Ont., Niagara Falls—Lionite Abrasive Ltd., Stanley St., H. A. Richmond, genl. mgr., 625 Buffalo Ave., Niagara Falls, N. Y., steel for 1 story, 85 x 360 ft. factory, to Standard Steel Constr. Co., Welland; concrete, to R. O. Towell, 870 Valley Way. Total est. $500,000.

GARAGES

Proposed Work

Ind., Ft. Wayne — La Barbarea Truck Co., 3504 South Calhoun St., plans by E. I. Brown, 1st Natl. Bank Bldg., 1 story, basement, 80 x 160 ft., brick, rein.-con., Taylor St. $42,160.

N. Y., New York—McSim Realty Corp., R. Simberg, pres., soon takes bids general contract concrete auto laundry and service garage, Boston Rd. and 170th St. $40,000. A. J. Simberg, 1133 Bway., archt. Noted July 18.

N. Y., New York — Ninety Fourth Street Holding Corp., 1619 52nd St., Brooklyn, plans by W. Shary, 22 East 17th St., 4 story, concrete, service garage, 312 East 94th St., $125,000. Maturity in 1930. Noted July 25.

Bids Asked

Mass., Brookline — See "Contracts Awarded."

Mass., Everett—See "Contracts Awarded."

N. Y., Brooklyn—Spetsas Realty Corp., J. A. Venetese, 379 Washington Ave., taking bids altering 1 and 2 story service garage, Bolivar and Raymond Sts. Seelig & Finkelstein, 153 Pierrepont St., archts. Noted Aug. 1.

Contracts Awarded

Ind., Brazil—Western Oil Co., general contract, to J. M. Cutshall & Son, Brazil. Est. $46,100.

Ind., Evansville—F. W. Cook, general contract, brick, steel, incl. garage, 208 South 8th St., to Lone & Smith, 812 Lincoln St., $44,200.

Mass., Brookline—A. Snyder and M. Rudnick, 18 Tremont St., Boston, 3 story, basement, 100 x 155 ft., rein.-con., steel, auto showroom, garage and repair shop, plain found., 734 Commonwealth Ave., separate contracts, $250,000. H. F. Bryant & Son, 334 Washington St., archts. Noted July 11 under "Buildings—Industrial."

Mass., Everett—B. Movitz, 431 Bway., 1 story, 120 x 135 ft., brick, steel service and repair garage, plain found., Courtland St., separate contracts. Est. exceeds $40,000. Private plans.

Tex., San Antonio—Roth Bros., 311 North Flores St., gunite foundation reinforcing for 3 story, brick, tile, rein.-con. garage, North Flores St., to National Gunnite Co., Phila., Pa. Total est. $40,000. Noted June 6.

SHOPS AND FOUNDRIES

Bids Asked

Calif., Los Angeles—R. D. King, archt., Van Nuys Bldg., taking bids, shop, 97 x 150 ft., also paint shop addition, 50 x 80 ft., both 1 story, brick, 15th St. and Central Ave., for Standard Auto Body Works, 15th and Central Ave.

N. Y., Brooklyn—See "Contracts Awarded."

Contracts Awarded

Conn., Groton—Vanadium Metals Co., Post Rd., 1 story, 50 x 120 ft., brick, steel foundry, to H. R. Douglas & Son, Barrows Bldg., New London. Est. $40,000.

Ind., Evansville — Evansville Quality Co., brick, steel machine shop, incl. garage, Water St. $43,000. Owner builds. Thole & Legeman, American Trust Bldg., archts.

N. Y., Brooklyn — United American Metal Corp., 59 Paige St., 2 story, 125 x 125 ft. shop, Scott Ave. and Randolph St., day labor and separate contracts, $40,000. G. Erda, 788 Manhattan Ave., archt. Noted Aug. 1.

Vt., Barre—Wetmore Morse Granite Co., 1 story, 50 x 160 ft., brick, terra cotta, tile machine and blacksmith shop. Est. $52,000. Owner builds. L. F. Caroni & Co., 1056 Chapel St., New Haven, Conn., archts.

Wis., Racine—Belle City Malleable Iron Co., Kewaunee St., 2 story, 60 x 180 ft., brick, steel foundry addition, plain found., to Nelson & Co., Inc., Racine.

POWER PLANTS

Proposed Work

Mass., West Springfield (br. Springfield)—Strathmore Paper Co., soon lets contract 1 story, brick, steel, hydro-electric plant, $40,000 or more. L. R. Howe, Mittimeague, or c/o owners, architect in charge. Noted Jan. 2.

Bids Asked

O., Columbus—Aug. 14, by Bd. Purchase, H. C. Cain, secy., City Hall, 1 steam turbine generating unit with all appurtenances, surface condenser, etc., for Municipal Light Plant.

B. C., Victoria—Aug. 31, by British Columbia Electric Ry. Co., 1684 Yale St., 15,500 hp. turbine generator, 2 mi. 60 in. steel pipe for Jordon River Hydro Electric Power Station addition. $1,500,000. G. M. Tripp, 1684 Yale St., engr.

Contracts Awarded

Conn., Bridgeport—United Illuminating Co., 1118 Broad St., 3 story, 80 x 150 ft., brick, steel, to Edward Bray Co., 362 River St. Est. $350,000. Noted Aug. 1 under "Contracts Awarded."

Conn., South Norwalk—Nash Engineering Co., Wilson Rd., 1 story, 30 x 180 ft., brick, steel, concrete addition. Est. $40,000. Owner builds. Private plans. Noted Feb. 28.

Mass., Worcester—M. J. Whittall Associates, steam power plant, to F. J. Sill, Westboro. Est. $400,000.

O., Ashtabula—Cleveland Electric Illuminating Co., Illuminating Bldg., Cleveland, foundation for 4 story, 250 x 325 ft., rein.-con. power plant, to Hunkin-Conkey Constr. Co., Newman-Stern Bldg., Cleveland. Total est. $11,000,000. Noted May 16, under "Buildings Industrial."

R. I., Slatersville—Kendall Mills, Slatersville Finishing Co. Div., brick, steel, concrete power plant and 40 x 180 ft. mangle building, to Temple & Crane, 80 Federal St., Boston, Mass. Noted July 18 under "Buildings—Industrial."

Ont., Windsor—Auto Specialties Ltd., Tecumseh Rd., 40 ft. diam., 65 ft. high, concrete, steel fuel house and heating plant, to Holbeck Eng. Co., Penton Bldg., Cleveland, O. Est. $78,000.

UNCLASSIFIED

Proposed Work

Conn., Waterbury—COLD STORAGE PLANT—Fulton Markets Inc., C. Greenblatt, West Main St., 2 story, basement, brick, West Main St., $40,000 or more. Private plans.

N. Y., Brooklyn—BAKERY—Purity Bread Corp., W. Hirschman, pres., 1819 Bway., New York, plans by M. W. Del Gaudio, 545 5th Ave., 2 story, 78 x 121 ft. brick factory, storage and garage, Sterling Pl. and Nostrand Ave., $65,000.

N. C., Greensboro—FREIGHT STATION—Southern Ry., B. Herman, ch. engr., Construction Dpt., Wash., D. C., plans freight station, incl. offices, $250,000.

N. C., West Jefferson—CHEESE FACTORY—Kraft-Phenix Cheese Corp., c/o Chamber of Commerce, plans cheese factory, $100,000.

O., Dayton—BAKERY—Green & Green Co., Cincinnati St., 4 to 6 story rein.-con., brick addition, Cincinnati St., $500,000. Engineer and architect not selected.

Tex., Raymondville—CANNING PLANT—Austin Brokerage Co., c/o C. A. Austin, pres., soon lets contract, 2 story, brick, rein.-con., canning plant, San Perlita near here, $50,000. Private plans.

Ont., Hamilton — BAKERY — Jackson Bread Co., 46 Leeming St., L. Jackson, mgr., addition, Leeming St.

Bids Asked

Calif., San Francisco—PUBLISHING PLANT—H. H. Meyers, archt., Kohl Bldg., taking bids 5 story, basement, rein.-con., 1st and Tehama Sts., for Phillips & Van Orden Co., 511 Howard St. $200,000. Noted May 9.

Conn., Middletown—SERVICE—Aug. 13, by Connecticut Power Co., 335 Main St., 2 story, 50 x 80 ft., brick and steel service building, incl. office, Columbia Ave. $100,000. Davis & Waldorff, 17 Whitney Ave., New Haven, archts.

Mich., Detroit—WAREHOUSE—Aug. 12, by J. S. Foley, secy., Pub. Lighting Comn., 174 East Atwater St., 1 story, 200 x 300 ft., rein.-con., brick, steel, plain found., incl. shop, Southfield Rd. $150,000. Smith, Hinchman & Grylls, 800 Marquette Bldg., archts.

Contracts Awarded

N. J., Newark — Dugan Bros., Inc., 161 Abington Ave., general contract 1 story, 70 x 200 ft., brick, steel addition, plain found., to Federal Constr. Co., 649 Bway. Est. $40,000. M. N. Shoemaker, 15 Central Ave., archt.

N. J., West New York—LAUNDRY — J. J. Gloster, archt., 1440 Bway., New York, 2 story, basement, brick, steel addition, plain found., 630 17th St., to G. Adie, 132 28th St., North Bergen, for Victor Laundry Service, 132 28th St., North Bergen. Est. $40,000. Noted May 23.

N. Y., Rensselaer — INDUSTRIAL WAREHOUSE—General Aniline Works, 230 5th Ave., New York, 100 x 402 ft. to White Constr. Co., 95 Madison Ave., New York. Est. $300,000.

See proposal advertising on page 125

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UNIT PRICES

Street Improvement—Akron, O.

Department of Public Service, Division of Highways, opened bids June 10 improvement of South Martha Ave. and Seiberling St. E. A. Kemmler, highway engineer, states that these bids for a major street improvement are the lowest received since 1921. With these prices, 3-in. asphalt on 6-in. conc. base can be constructed for $2.39, against $3.19 for 3½-in. brick on same foundation, under bid of low bidder on brick. Bidders are: (A) Engineer's Estimate; (B) The Columbus Asphalt Paving Co., 304 Buckeye Bldg. (awarded contract*); (C) The Hollinger-Davidson Co.; (D) McAlonan Bros., 506 Woodland Ave.; (E) T. E. McShaffery Construction Co.; (F) McCourt Construction Co.; (G) Thorpe Construction Co.

	A	B	C	D	E	F	G
28,000 cu yd. grading	$0.50	$0.20	$0.30	$0.38	$0.40	$0.40	$0.46
330 cu yd. trench excav.	1.50	1.00	1.00	1.00	1.00	2.00	1.50
12,150 lin ft. under-drainage 4 ft. pipe	.10	.05	.01	.02	.04	.01	.05
1,630 lin ft. inlet connections 12-in. pipe	2.00	1.00	1.00	.80	.75	1.00	1.00
1,960 lin ft. drains, 15-in. pipe	2.50	1.40	1.65	1.75	1.25	1.40	2.25
675 lin ft. drains, 18-in. pipe	3.00	2.00	2.10	2.00	2.00	1.80	2.75
285 lin ft. drains, 20-ft. pipe	2.60	2.00	2.50	3.00	2.00	2.20	3.25
1,280 lin ft. drains, 24-in. pipe	4.50	3.00	3.00	3.00	3.25	3.20	3.60
1,370 lin ft. sewers, 8-in. pipe	2.00	1.50	1.75	1.50	2.00	1.80	2.00
106 sewer laterals	30.00	27.00	28.00	15.00	25.00	25.00	30.00
35 manholes complete	90.00	85.00	60.00	75.00	75.00	80.00	95.00
17 manholes readjusted to grade	10.00	2.00	2.00	5.00	5.00	5.00	4.00
1 new manhole frame and cover	20.00	20.00	14.00	12.00	17.00	20.00	20.00
5 lin ft. manholes rebuilt	8.00	10.00	5.00	5.00	5.00	7.00	6.00
46 inlets plan 3	50.00	40.00	35.00	35.00	35.00	35.00	34.00
1 inlet, Type D	40.00	40.00	40.00	30.00		40.00	34.00
20 cu yd. conc., Class 2	12.00	12.00	9.00	9.00	8.00	10.00	11.00
300 cu yd. conc., Class 2 ret. wall	14.00	13.00	12.00	12.00	16.00	12.80	18.00
350 cu yd. conc., Class 3	10.00	10.00	8.50	8.00	8.00	7.00	8.00
5 cu yd. brick masonry	25.00	20.00	8.00	20.00	5.00	20.00	20.00
10,140 lin ft. sandstone curb (6 x 18 in.) hand dressed	1.40	1.45	1.40	1.50	1.35	1.40	1.40
10,140 lin ft. sandstone curb (5 x 18 in.) hand dressed	1.35	1.35	1.28	1.30	1.25	1.30	1.30
260 lin ft. sandstone circ. curb (6 x 18 in.)	2.25	2.50	2.10	2.50	2.25	2.20	2.25
1,550 lin ft. granite circ. curb (6 x 18 in.) Class A	3.10	3.10	2.70	3.00	3.00	3.00	2.70
1,550 lin ft. granite circ. curb (6 x 18 in.), Class B	3.00	3.00	2.60	2.90	2.75	2.80	2.70
200 lin ft. sandstone curb redressed	.30	.30	.20	.20	.50	.20	.40
200 lin ft. curb reset	.60	.50	.40	.20	.50	.70	.40
845 lin ft. sandstone headers	1.00	1.00	.90	1.00	1.00	1.00	.90
120 lin ft. granite headers	2.50	2.00	1.90	1.10	2.00	2.00	1.85
28,885 sq yd. conc. base, 5 in. thick	1.20	1.02	1.12	1.20	1.10	1.30	1.20
28,885 sq yd. conc. base, 6 in. thick	1.35	1.19	1.25	1.30	1.30	1.40	1.35
28,885 sq yd. conc. base, 7 in. thick	1.55	1.37	1.45	1.50	1.40	1.60	1.55
28,885 sq yd. conc. base, 8-in. thick	1.75	1.55	1.65	1.70	1.70	1.80	1.80
28,885 sq yd. curing base	.04	.04	.03	.03	.02	.04	.02
28,885 sq yd. repressed brick pavement, asphalt filler	2.10	2.12	2.08	2.10	2.30	2.30	2.15
28,885 sq yd. 3½ V. F. brick pavement, asphalt filler	2.00	1.95	1.94	1.90	2.20	2.10	2.09
4,200 sq yd. repr'd. brick gutter, asphalt filler	2.20	2.15	2.10		2.20	2.20	2.20
4,200 sq yd. 3 in. V. F. brick gutter, asphalt filler	2.10	1.93	1.90		1.90	1.90	1.90
24,685 sq yd. sheet asphalt pavement, Plan B (Trinidad)	1.50	1.30	1.40		1.30	1.40	1.40
24,685 sq yd. sheet asphalt pavement, plan B (Texaco)	1.40	1.20	1.30		1.20	1.30	1.30
24,685 sq yd. sheet asphalt pavement, Plan B (Mexican)	1.40	1.20				1.30	1.30
230 sq yd. brick pavement relaid	2.00	2.00	1.00	1.00	1.00	2.00	1.50
51,150 sq ft. cement walk two-course	.22	.20	.18	.20	.20	.20	.20
3,100 sq ft. cement driveway	.28	.25	.22	.24	.25	.25	.25
200 sq ft. cement walks relaid	.15	.10	.10	.08	.02	.10	.10
5,000 lb. reinforcing steel	.05	.04	.04	.05	.05	.05	.04
180 lin ft. galv. iron pipe railing (2½ in.)	2.50	2.50	2.00	2.50	2.50	2.20	2.50
180 lin ft. galv. iron pipe railing (2 in.)	2.25	2.00	1.70	2.00	2.00	2.00	2.00
13 street signs acc. No. 5960	15.00	15.00	15.00	15.00	15.00	15.00	15.00
1 ton asphaltic binder (Trinidad)	9.00	6.00			8.00	10.00	9.00
1 ton asphaltic binder (Texaco)	8.00	5.50			7.00	10.00	8.00
1 ton asphaltic binder (Mexican)	8.00	5.50				10.00	8.00
100 cu yd. cinders	1.00	.10	.70	1.00	1.00	.10	.70
500 lin ft. 4-in. W. I. drain	.40	.30	.20	.40	.20	.20	.25
120 lin ft. 84 in. corrugated culvert	27.00	20.00	16.00	20.00	20.00	16.80	25.00
20 water valve boxes readj.	1.00	1.00	1.00	1.00	.50	2.00	1.50
115 lin ft. 39 in. seg. block drain	10.00	5.50	5.75	6.00	6.50	8.00	9.00
115 lin ft. 39-in. brick drain	10.00	6.75	6.50	7.00	8.50	9.00	12.00
685 lin ft. 45-in. seg. block drain	13.00	8.00	8.50	7.00	9.00	8.00	12.00
685 lin ft. 45 in. brick drain	13.00	10.00	10.50	8.00	11.00	9.00	16.50
50 lin ft. 6-in. V. P. sewer	1.00	1.00	1.00	1.00	1.00	1.00	1.25
895 lin ft. 10-in. V.P. sewer	2.50	1.65	2.00	2.00	2.10	2.00	2.10
815 lin ft. 8-in. under-drain	.60	.15	.15	.10	.02	.02	1.90
5 T or Y branches on 8-in. vitr. pipe	1.00	2.00	2.00	1.50	2.00	2.00	4.00
1 T or Y branches on 10-in. vitr. pipe	2.00	2.00	3.00	2.00	3.00	2.00	5.00
150 cu yd. gravel refill	3.00	1.00	2.50	3.00	.10	2.00	3.00
100 M ft. B. M. sheeting left in place	30.00	1.00	.10	20.00	1.00	1.00	40.00
1 headwall	200.00	150.00	100.00	200.00	150.00	70.00	80.00
10 6-in. vitr. pipe bends	1.00	1.00	1.00	1.00	2.00	1.00	3.00
If cement is required for the cushion, add per sq.yd.	.15	.15	.15	.15	.20	.20	.15
If cinder base for cement walk is omitted, deduct per sq.ft.	.02	.02	.02	.02	.02	.02	.02
Totals: repressed brick pavement, 6-in. base	$207,385	$177,062	$176,172	$183,057	$189,618	$191,342	$204,875
Totals: 3½-in. vert. fibre brick pavement, 6-in. base	204,496	172,152	172,128	177,280	186,730	185,565	203,142
Totals: sheet asphalt pavement, Plan B (Trinidad) 3-in. brick gutter, 5 and 7 in. base	197,301	158,238*	163,862	.....	166,142	173,223	190,878
Totals: sheet asphalt pavement, Plan B (Texaco) 3-in. brick gutter, 5 and 7-in. base	194,832	158,207	161,393	.....	163,673	170,754	188,410
Totals: sheet asphalt pavement, Plan B (Mexican), 3-in. brick gutter, 5 and 7-in. base	194,832	158,207	.....	.....	.....	170,754	188,410

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